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EDITORIAL NOTE

We welcome in this number the first appearance of a leading article contributed by scientists overseas. It will come out in three parts, in successive numbers of this journal, the bibliography being appended to Part III. Requests for reprints of the whole, which will be No. 23 in the Leader series, should please be made early to this Bureau.

THE USE OF AIRCRAFT IN FOREST INSECT CONTROL[1]

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1. INTRODUCTION

The use of aircraft in forestry has increased rapidly during the past 10 years. The aeroplane and the helicopter have obvious advantages for transport, observation, and survey work in the protection and management of large forested areas. Their possibilities are of particular interest in forest entomology, not only as a means of rapid detection and survey of outbreaks but also for the application of insecticides.

Chemical control of forest insects has hitherto been limited by the difficulties and cost of application. It has also been deprecated by some as unsuited to forest crops. The long period necessary for a stand to reach maturity and the comparatively low annual financial return per acre preclude the frequent use of insecticides that has been found profitable with many agricultural crops. The complex faunal and floral structure of forest communities increases the danger that treating them with poisons will affect beneficial elements, disturb the natural balance between species, and create new problems. Often, however, the use of chemicals is the only means of preventing serious damage and avoiding the major ecological disturbances that follow destruction of the stand. Recent developments in the

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techniques of aerial spraying have removed many of the practical difficulties and the method will undoubtedly be used more widely in the future.

The purpose of this paper is to review the history of the use of aircraft in forest insect work, to summarize the problems involved, and to assess the progress to date. Much interesting work has been done on aerial control of non-forest insects but this will be omitted. A large amount of literature has been published on the general subject of aviation in economic entomology and the reader is referred to Hawes and Eisenberg's excellent bibliography which lists 1084 titles up to 1947 [75]. The present review attempts to bring together the information that will be of chief interest to forest entomologists and to forest officers concerned with protection and management.

2. HISTORY

The first use of aircraft in forestry was for forest insect work and followed rapidly on development of the aeroplane during World War I. In 1919, Hewitt [77] described its value in detecting and surveying outbreaks over the large, inaccessible forest areas of Canada, and Swaine [147] recorded the mapping of areas attacked by the Spruce budworm (*Choristoneura fumiferana* (Clem.)), with the aid of a hydroplane in 1920. Since then aircraft have been used increasingly for insect surveys, particularly in North America [91].

At the same time the possibilities of aerial application of insecticides were being considered in Europe, America, and the U.S.S.R. This had been suggested as early as 1913 by Johansen [90]. The first test was made in Ohio, U.S.A., in 1921, when a plantation infested with the Catalpa sphinx (*Ceratomia catalpae* Bvd.) was dusted with Pb arsenate from a hopper placed on the side of a Curtis J.N.6 [84]. The speed and effectiveness of this operation encouraged a number of further trials against pests of trees and cotton during the next few years [in 75]. Various types of equipment, including the dirigible, were tried and commercial operations on a limited scale began in the U.S.A. about 1927 [67].

The first trial under forest conditions was in Wisconsin against the Hemlock looper (*Ellopia fiscellaria* Gn.) in 1925 [in 75]. Two years later, a series of experiments on aerial dusting was commenced in Canada against the Spruce budworm and the Hemlock looper. By 1930, it was concluded that the method was practicable against insects like the looper but not yet satisfactory against the budworm, for which more suitable insecticides and equipment needed to be developed [149]. Similar conclusions were drawn in the U.S.A. from work on these species and the gipsy moth (*Porthetria dispar* (L.)), and attention was turned to the possibilities of concentrated sprays to diminish drift, improve adherence, and reduce dependence on weather [171]. The autogiro was also tested [121], 2 square miles of woodland infested with gipsy moth being treated from this machine in 1942.

In Europe, aerial dusting began in Germany and Czechoslovakia in 1925 against the nun moth (*Lymantria monacha* L.) [98]. Its use was encouraged by the relatively high value per acre of German forests. Numerous tests and control operations were carried out against the nun moth, the Pine looper (*Bupalus piniarius* L.), the Oak leaf-roller (*Tortrix viridana* L.), the Pine sawfly (*Diprion pini* L.), and *Melolontha* spp. [in 75]. In 1928, over 34,000 acres of forest land were dusted in Germany [154] and in 1931–32 an area of 150,000 acres infested with Pine looper was treated with a veratrine [Sabadilla alkaloid] dust [33]. The danger of poisoning bees and animals with arsenical dusts was of particular concern in Europe, and the poor adherence of dusts limited their effectiveness as stomach poisons in rainy weather. In Jugoslavia, the failure of a test against the nun moth was attributed to the poor quality of the Ca arsenate used [72]. Such difficulties, reported also from Poland and France, led to the increasing use of various contact insecticides, which were stated to cause mortalities of 87 to 100% [137].

In the U.S.S.R., a trial of aerial spraying in 1922 [114] was followed in 1924 by experiments with dust, suggested by work in N. America. The first dusting against a forest insect was in 1926, for a nun-moth outbreak [107]. Other species dusted from the air during the next few years were the Oak leaf-roller, the Siberian Pine moth (*Dendrolimus sibiricus* Tshtv.), and the Pine looper. In 1939, the Pine moth (*D. pini* L.) was treated with pyrethrum dust [120*a*]. A number of 'expeditions' were organized in Russia for the development of aerial spraying, chiefly against locusts and mosquitoes. The literature emphasizes the problems of organization and the necessity for training specialists. It combines criticism of the work with enthusiasm for its future and suggests that only socialized agriculture can make full use of aerochemical control [75].

In S. Africa an aeroplane was used to apply Ca arsenate to the Eucalyptus snout beetle (*Gonipterus scutellatus* Gyll.) as early as 1926. Results were disappointing, but 10 years later a more promising test was made on the Pine browntail moth (*Euproctis terminalis* Walk.) [152], and in 1939 good control was obtained of the Wattle bagworm (*Acanthopsyche junodi* Heyl.) with cryolite. The only other

instance of aerial dusting in the British Commonwealth against forest insects before World War II was in Australia, where an infestation of case moths (*Cryptothelea* spp.) was successfully treated in 1931 [in 75].

Up to World War II aircraft were used in forest pest control almost exclusively to apply dusts. Studies of the results were of varying intensity, but do not seem to have gone beyond an assessment of the immediate effects on the pest populations. In general, they indicated that the method was practicable against defoliators and of particular value for large forests in danger of being killed or severely damaged. Several difficulties, however, remained. The dust cloud would settle only in fairly calm weather and in the absence of upward thermal air currents. The dust was easily washed off by rain, a difficulty partly overcome by the use of contact dusts, although these sometimes caused burning of foliage. There was also a need to reduce costs and to develop methods of controlling the flight of planes over larger, inaccessible areas so that proper coverage could be obtained without markers. Above all, a cheap, highly toxic insecticide was needed.

Attempts had been made in the U.S.A. to solve some of these problems by the use of highly concentrated sprays, but the quantity needed and the cost were high [171]. It was the discovery of the strong insecticidal properties of DDT during the war that was responsible for the major developments of the past decade. DDT was rapidly exploited by the U.S. Air Force and the Royal Air Force for aerial spraying of mosquitoes in 1944. In the same year tests were made with a DDT dust on the Pine looper in Sweden, with an oil solution of DDT on the gipsy moth and other species in the U.S.A., and with an oil solution on the Spruce budworm in Canada [in 75, 144]. Larger-scale projects were undertaken in America as fast as DDT became available for civilian use.

In Europe, since the war, DDT has been used mostly as a dust but also in oil solution, in emulsion, in water suspension, and as an aerosol. Gesarol, a DDT dust, was applied against a number of species in Germany, Poland, and Sweden [28], with generally good effect, although some difficulty was experienced with wind. It was feared by some entomologists that the biocoenosis would be impoverished by the killing of parasites and other beneficial species, a danger that would increase with large operations where replenishment would be slow [138]. This had already been pointed out in an exhaustive series of studies of the nun moth [163]. No evidence was obtained, however, that chemical control prolonged outbreaks. In 1949, spraying with DDT in mineral oil at a minimum rate of 2 kg./ha., was found to be fully effective, though costly, against the gipsy moth in Jugoslavia [142]. This was followed by tests with DDT aerosols, good results being obtained against the gipsy moth, the Pine processionary (*Thaumetopoea pityocampa* (Schiff.)) and the Pine sawfly, when the application was well timed and a suitable aeroplane used [17, 104, 174]. Spraying with an emulsion at 3·9 kg./ha. gave good control of cockchafers in France [71], but ground dusting was preferred for defoliators of Poplar plantations [16]. In Spain, a water suspension of DDT has been compared with BHC in suspension and emulsion. The treatments all gave about 80% mortality, BHC being more rapid, DDT more persistent, in action [38]. The available literature from the U.S.S.R. contains the following information on aerial dusting or spraying since the war. Na fluosilicate, used at 15 kg./ha. against the nun moth, gave 84·2% mortality [59*a*]. For controlling the Siberian Pine moth, dusting with 5·5% DDT at 10–50 kg./ha. (according to instar) is indicated as the most effective practical method; 7–12% BHC dusts gave inferior results, and mixed DDT/BHC was no better than DDT alone. Oil sprays of either insecticide, though more effective, are said to be troublesome to prepare and to reduce the working swath width. Ca arsenite can be used against the first 2, or Na fluosilicate against the first 4 instars. Na arsenite was too toxic to animals to be used safely. For operations in 1955 only DDT dust was to be used, from the large AN-2 aircraft which gives a swath width of 50 m. [84*a*, 114*a*]. Dusting with a 2 : 1 mixture of 5% DDT and 12% BHC at 16–20 kg./ha. gave 91–100% mortality of *Nygmia phaeorrhoea* L. in the Kuibyshev region; results from DDT or BHC alone were considerably inferior [27*a*]. In 1953, Oak stands in the Kiev region attacked by *N. phaeorrhoea* and *Malacosoma neustria* L. were practically freed of larvae by DDT at 5%, either in solar oil (50 litres/ha.) or as a mineral-oil emulsion (50 or 75 litres/ha.), applied from an AN-2 aircraft; 10% mineral-oil emulsions of DDT at 20–30 litres/ha. resulted in 86–99% mortality of *M. neustria* and *Tortrix viridana*. Oil solutions of DDT can be sprayed from heights of 15–20 m. with wind speeds up to 5 m./sec. [133*a*]. In aerial dusting trials in 1950–51 against adult cockchafers (*Melolontha* spp.) 5·5% DDT at 15, and 12% BHC at 20 kg./ha. gave kills of respectively 78 and 80%; in another trial, 10% DDT appeared to be more effective than 12% BHC at the same rate (15 kg./ha.), reducing oviposition by about 90% [99*a*]. In 1952, 12% BHC dusted at 15 or 16 kg./ha. killed 96–98% of the chafers, and in one instance markedly reduced the population of first-year grubs in the soil [96*a*, 140*b*]. The same two insecticides have also been tried against the acorn weevil *Balaninus glandium* Matsh. In 1952 'Dualit DDT 15%' dusted at 17–40 kg./ha., three times during the growing season, gave

high mortality and, especially at the higher dosages, greatly increased the yield of sound acorns in some Ukrainian Oak stands [17*a*]. Other stands were treated in the same year with 5·5% DDT dust (two applications, each of 10 kg./ha.) or with a mineral-oil emulsion of BHC diluted with water to a concentration of 1% technical BHC and applied at 100 litres/ha. The flying height was not more than 10 m. above the tree crowns, but ground dusting and spraying were used to supplement the treatment of the lower branches of trees on stand margins. Both insecticides gave excellent results. Further stands were successfully treated in 1953 with 5·5% DDT dust at 30 kg./ha. [17*b*].

In Czechoslovakia, aerial dusting with a 5% DDT preparation of Czech manufacture gave a poor kill of adult cockchafers [48*a*], but a 12% BHC dust is reported as having given 95% mortality after 3 days [140*a*]. A dusting operation with 21 aircraft was carried out against nun moth, using a DDT preparation (Gesarol) at rates of 30–50 kg./ha. The average mortality was 93% and the outbreak declined in the following year [93*a*]. An experiment was undertaken in South Africa in 1953 when toxaphene dissolved in Dissoline was tested against the Wattle bagworm at rates of 2¼ and 3 lb. in 3 and 4 gal./acre [116].

The greatest development in recent years has taken place in the U.S.A. and Canada, where large outbreaks of tree-killing defoliators, particularly the Spruce budworm, have coincided with a growing concern about their effect on wood supply and forest management. Techniques of application, timing, and formulations have been much studied. Experimental work has been combined with large control operations and U.S. and Canadian entomologists and foresters have co-operated in both, the basis being the discovery that high concentrations of DDT in oil could be applied more effectively and cheaply than dusts, with less dependence on weather and without injury to foliage. Studies of effects on fish and wildlife in both countries indicated that the chief danger was to fish, but that single applications of oil solution at the dosages most commonly used, would not have permanent or catastrophic effects [40, 79, 92].

In 1945, about 64,000 acres in Ontario were sprayed with DDT at 1 lb./acre to control the Spruce budworm. Defoliation was greatly reduced but reinfestation took place from moth flight, and the protection was not permanent [34]. In the same year, however, 12,000 acres attacked by the Hemlock looper were similarly treated in Oregon; high mortality was obtained and the outbreak subsided. A year later, another area of 29,000 acres of budworm-infested forest was sprayed in Ontario [144], over 90% mortality being obtained with 2 lb. DDT/acre. In 1947, over 400,000 acres infested by the Douglas Fir tussock moth (*Hemerocampa pseudotsugata* McD.) were sprayed in Idaho with apparent success [171].

During this period, extensive work on the gipsy moth showed that it was particularly susceptible to DDT owing to its habits of movement on the tree, and could be killed by as little as ¼ lb./acre, although 1 lb. was generally advisable [39]. This introduced pest has been the subject of continuous large-scale control measures in the north-eastern States, both to reduce damage and to check its spread. Aerial spraying with DDT has replaced previous methods of chemical control, and in 1954 about a million acres were treated. References to this extensive undertaking are unfortunately scant.

These and smaller operations were accompanied by a good deal of research in the U.S.A. on equipment, swath width, droplet size of the spray cloud, and timing [49]. American entomologists have been responsible for much of the pioneer work in this field. The growth of commercial spraying and dusting in agriculture helped to build up a considerable force of planes and experienced pilots that facilitated the undertaking of larger projects, particularly against the Spruce budworm. The formulation generally used was 1 lb. of DDT dissolved in a naphthenic solvent and diluted with No. 2 fuel oil. One U.S. gal./acre was found to suffice for good coverage and a high mortality % of most defoliators. Two-seater, trainer-type biplanes proved to be excellent for forest work owing to their high manoeuvrability, although their limited range often called for construction of special airfields. The advantages of the helicopter were more than offset by its high cost.

Tests in Oregon in 1948 [49] were followed by a series of large operations to control the Spruce budworm in the north-western States. Between 1949 and 1954 a total of 3,220,000 acres was treated [10]. Reports of over 99% mortality obtained at a cost of about $1·00/acre encouraged the commencement of spraying in eastern Canada to prevent the killing of large areas of forest by this insect [21, 24, 65, 160] and some 3,430,000 acres were sprayed in New Brunswick and Quebec between 1952 and 1955. These two projects have many features in common. Close collaboration between entomologists and foresters in the U.S.A. and Canada has resulted in the use of similar methods, but some differences have developed owing to differences in conditions. As they are the most recent and most extensive aerochemical control operations, and are directed against one of the most destructive forest pests, the methods and results will be discussed in more detail below.

Another interesting use of the aeroplane has been for the dissemination of a virus that attacks the European Pine sawfly (*Neodiprion sertifer* (Geoffr.)). A Piper Cub plane with a boom-type sprayer was employed by Bird in Ontario to spray plantations with suspensions containing from 200,000 to 5,000,000 polyhedra per millilitre at ½ gal./acre [29]. The results were very promising and with increasing attention being given to viruses in biological control work, the aeroplane will undoubtedly be of value in facilitating their rapid dissemination, especially in less accessible areas. It is already in frequent use for transporting insect parasites and predators from the laboratory to the forest for the control of introduced species. The Forest Biology Division has used planes to take parasites and virus extract to the forest for liberation [18]. Regular airlines are used by the British Commonwealth Bureau of Biological Control and the Biological Control Unit of the Division of Entomology for shipments from Europe to Canada, and from the Belleville Laboratory to points from which liberations are made.

3. AERIAL SURVEYS

(A) PURPOSES

Aerial surveys are especially useful to the forest entomologist for the detection and appraisal of insect outbreaks and damage over large tracts of remote and relatively inaccessible forests. Although ground surveys are usually essential, they are often difficult and expensive and may provide limited information on the true extent and severity of large outbreaks. Aerial surveys to supplement ground information have had particularly useful application in Canada and the U.S.A. owing to the extensive forested areas and the increasing importance of timber resources in remote areas [73, 91, 171].

Following the early Spruce budworm surveys in eastern Canada [147, 150] attempts were made, beginning in 1925, to survey barkbeetle outbreaks in the eastern and western U.S.A., but with limited success [91, 171]. In 1931, an aeroplane was used to map some 2500 square miles in Quebec defoliated by the Spruce sawfly (*Diprion hercyniae* (Htg.)) [23], and the first recorded surveys of defoliation damage in the Pacific Northwest were made to map Hemlock looper damage in Washington [156*a*]. In European literature, Raumer [126] discusses the advantages to the forester of 'working in three dimensions', and Mokeev [108] mentions the use of aircraft for forest inspections and insect control in Russian forests.

The earliest surveys in N. America were undertaken primarily to assess damage and locate dead and dying timber for salvage purposes. As the possibilities become more evident with the rapid development of flying facilities, increased attention was focussed on the detection of incipient outbreaks, mapping their progress, and classifying stands according to the need for control and 'pre-salvage' operations. In recent years, aerial patrols have become an important adjunct to systematic annual surveys of insect conditions by the Canadian Forest Insect Survey and State and Federal pest-detection agencies in the U.S.A. Combined aerial and ground surveys of Spruce budworm infestations have been under way in Ontario since the early 1940's and this insect is currently receiving attention over immense areas in the north-eastern and north-western U.S.A. and most of the Canadian Provinces. Since 1949, up to 49 million acres have been surveyed annually in Oregon and Washington, to provide detailed information on this and other insects including the Douglas Fir beetle (*Dendroctonus pseudotsugae* Hopk.), western Pine beetle (*D. brevicomis* Lec.), mountain Pine beetle (*D. monticolae* Hopk.), Engelmann Spruce beetle (*D. engelmanni* Hopk.), Lodgepole Pine sawfly (*Neodiprion* sp.), Hemlock looper (*Lambdina lugubrosa* Hlst.), Spruce aphid (*Neomyzaphis abietina* (Walk.)), and Balsam woolly aphid (*Adelges piceae* (Ratz.)) [10, 156*a*]. Outbreaks of the forest tent caterpillar (*Malacosoma disstria* Hbn.) in the north-eastern U.S.A. and Canada, and the Hemlock looper in British Columbia and Newfoundland, have also been mapped largely by aerial methods in recent years, and the Larch sawfly (*Pristiphora erichsonii* Htg.) is currently receiving attention over some 15 million acres in the Lake States [26].

Among the more recent adaptations of aerial methods are those in connexion with large-scale spraying operations against Spruce budworm. In addition to annual surveys of outbreak conditions in New Brunswick and Quebec, aircraft are being used for locating 'hazard areas' in need of treatment, assessing foliage development for timing sprayings, appraising results in terms of foliage protection, and supervising the operation of the spray aircraft [159].

(B) TECHNIQUES

The detection of unusual insect activity from the air is based on abnormal colour differences in trees and stands. The aerial observer has an advantage over ground parties in that he has a better view of the tops of the tree crowns, where such differences are likely to appear first. The stage in an outbreak at which damage first becomes apparent varies with the insect and the mode of attack. Outbreaks of defoliators of conifers may often be detected in incipient stages by the browning of the terminal

shoots. Such is the case with the Spruce budworm. More complete stripping of the foliage from the branches, such as may occur after successive attacks on non-deciduous host species or a single year's attack on deciduous trees, is discernible from the grey appearance of the bare crowns. Thus, the first signs of attack may often be detected from 1 to several years before tree mortality is imminent. A somewhat different situation occurs with insects that attack under or through the bark; here, changes in foliage colour usually foretell the death of the tree, and therefore the earliest indications of such outbreaks suggest the need for immediate salvage as well as pre-salvage or control measures [156*a*].

Yuill and Eaton [171] distinguish 3 types of aerial surveys. These will be discussed as: (1) reconnaissance sketch-mapping, (2) line-strip surveys, and (3) photography.

Reconnaissance sketch-mapping. This is the simplest and most widely used method. It has the advantages of economy of time and expense and may sometimes be combined with surveys for other purposes such as forest fire patrols. An observer sketches the boundaries of infestation or damage on maps or aerial photographs. Flights are made more or less systematically at the maximum height from which it is possible to recognize the condition, so as to examine as large an area as possible with a minimum of flying [150]. The method has had wide use in Ontario for mapping Spruce budworm outbreaks in 6 categories from light infestation to completely dead stands. Light, moderate, and severe defoliation by this insect and others, including the black-headed budworm (*Acleris variana* Fern.) and the forest tent caterpillar, have been successfully distinguished from heights of 1000 to 4000 ft. in New Brunswick. Damage from Southern Pine beetle (*Dendroctonus frontalis* Zimm.) has been assessed from 2000 to 5000 ft. in south-eastern Texas and Mississippi [91]. The accuracy of assessments is, of course, dependent on the judgement of skilled observers and calls for extensive ground checks.

Line-strip surveys. Low-level surveys are frequently necessary to obtain more detailed information on incipient outbreaks, to spot infested trees, or to prepare accurate maps for control operations. Owing to the difficulties of low-level navigation, these usually consist of a partial strip cruise along predetermined lines, with the observer making systematic observations or counts either continuously or at intervals. It has been reported that 15% current defoliation by the Spruce budworm can be detected from about 200 ft. above the forest [76]. Heights of 200 to 500 ft. are recommended for locating trees affected by Oak wilt in the north-central U.S.A. and pole blight of Western White Pine in the northern Rocky Mountain region [66]. Similar altitudes are necessary for the accurate detection of barkbeetle-infested trees.

Foremost among the improved techniques in this category are those developed by the Division of Forest Insect Research, U.S. Forest Service (formerly the Bureau of Entomology and Plant Quarantine). A device called the "aerial strip viewer" has been used in the western States for recording the incidence of barkbeetle-attacked trees [25]. The observer watches the forest through an aperture in the bottom of the fuselage and counts the affected trees along the visible sample strip. A mechanical 'operation recorder' for low-level surveys of Spruce budworm defoliation in Maine has been described [76], whereby a continuous record of observed conditions is transcribed on a moving chart by operating several switches on a keyboard. Observers may work in pairs or singly, and the pilot also records identified ground points on the chart by means of a Morse key. In drawing the infestation map, distances on the chart for various categories of infestation are proportioned between ground check points. Finally, the map is 'contoured' to outline areas of similar infestation. The categories sampled in the 1950 Maine surveys were 'no observed defoliation', 'scattered defoliation', 'continuous defoliation', and records were kept of non-susceptible areas. Distances between flight lines varied from 3 to 10 miles according to the intensity of the outbreak. A total of 10 million acres were sampled in 2½ weeks by 2 observers and 1 aircraft, flying a total of 44 hours.

The operation recorder has also been used to map 3 categories of defoliation by the Larch sawfly in the Lake States. In 1954, flight lines at 12-mile intervals were flown east and west and observations made on 20-chain strips to produce a 2·1% cruise. The results were found to agree well with ground surveys [26].

The line-strip method has recently been adopted for Spruce budworm surveys in New Brunswick. High-level reconnaissances had been made annually since 1948. With the start of the large-scale spraying operation in 1952, more intensive surveys were required to provide detailed information on the severity of damage and results of spraying, as well as on the extension of the outbreak. In 1954, flights were made at 200 to 300 ft. on east-west flight lines 2 to 5 miles apart. Estimates were recorded, at 30-second intervals, of defoliation of the current year's shoots as shown by redness of the foliage, and total accumulated damage as evident from the thinness and greyness of the crowns. Both were recorded in 3 categories, 'slight', 'moderate', and 'marked'. Stand composition was

roughly typed by coding the principal tree species in order of their predominance, and notes were taken of apparent recovery of foliage growth on severely-damaged trees, due to spraying. These data were tallied by ticking off the appropriate categories on specially prepared forms. The pilot and observer collaborated in recording the time of crossing identified ground points and in plotting actual flight lines on the map. Separate maps of current defoliation and total damage were prepared by proportioning the observations between ground check points. These were subsequently combined with the data from ground surveys for the preparation of a summary hazard map, considering current defoliation, total damage, and prospects for continued attack as indicated by egg counts. The data may also be analysed, using mechanical sorting methods, for differences in infestation and spraying results by stand types, date of spraying, etc. This survey covered over 10 million acres in New Brunswick. A total of 5 observation aircraft (Cessna 170) and 8 observers took part, completing the operation in 6 days or 118 flying hours, including ferrying time. Air-to-ground communications were used for relaying flight plans and details of progress to a project co-ordinator. A helicopter was used for instructing observers and for stand-by search and rescue purposes.

The accuracy of information obtained on aerial surveys is almost wholly dependent on the competence of the observer and the skill of the pilot. It is therefore essential that observers be adequately trained and experienced in the conditions to be observed. Pilots should be reasonably familiar with the areas to be surveyed, and skilled in low flying and navigational techniques. Confusion is sometimes caused by varying light conditions, and it is inadvisable to attempt surveys based on colour differences in the early morning or late afternoon, owing to the deceptive effect of shadows. Wright and Graham [168] also recognized the advisability of orientating flights to take the best advantage of the direction of the light.

Aerial photography. Possibly the most promising field for future development of aerial surveying techniques lies in the use of aerial photography. This method provides a permanent record of forest conditions and may reduce errors in judgement likely to result from rapid visual observations. At present the chief disadvantage is the relatively high cost in comparison with visual methods. Photographic scales suitable for adequate interpretation of detail are usually larger than for forest management and cartographic purposes, and better results are obtained with the relatively expensive colour film than with black-and-white.

Experimental work in this field has been undertaken in recent years in the U.S.A. with particular reference to assessing barkbeetle damage. "Preliminary results indicate that aerial photographs taken with proper film/filter/scale combinations constitute a very useful means for detecting and appraising insect outbreaks. They perhaps show greatest promise for appraising damage on a tree-by-tree basis in localized areas where insect infestations are either suspected or known to exist" [156]. The practical application of the technique is currently being tested in the Pacific Northwest by annual photography of permanent sample strips in Douglas Fir stands. At scales of 1 : 6000 and 1 : 7920, it has been found possible to locate beetle-killed trees for salvage operations and to follow the progress of outbreaks [11]. Control measures against White Pine weevil (*Pissodes strobi* Peck) in plantations were successfully evaluated by large-scale colour photography (1 : 1200) at about half the cost of a comparable ground survey. Sample cruising of Spruce budworm infestations in Maine at the scale of 1 : 2400, however, proved more expensive and less satisfactory than visual methods [91].

The superiority of colour film results from the strong contrast between green and yellow- or reddish-browns. Panchromatic black-and-white film, although less expensive and providing wider operational tolerances, gives inferior results. Infra-red film is even less satisfactory. The use of filters has been found to improve desired contrasts; A-25, G and K1 filters are mentioned as giving the best results.

Johnson [91], summarizing the possibilities, writes: "There are potentialities in the use of aerial photographs in forest-pest detection, but as yet there are many problems that must be solved. The chances are that aerial photographs will never supplant the visual scouting technique, but they may well supplement it in certain cases".

(c) TYPES OF AIRCRAFT

A fairly wide variety of aircraft has been used on aerial surveys. Swaine's reconnaissances were made in an open-cockpit hydroplane. Autogiros have been used to locate trees infected by the Dutch Elm disease [171]. The helicopter was found highly satisfactory for spotting trees affected by Oak wilt, but was more expensive than conventional aircraft [66]. For low-level surveys, small, high-wing monoplanes are generally most satisfactory owing to their slow speeds and the good visibility obtainable from them. Among the types commonly used in Canada and the U.S.A. are the Cessna, Stinson, Piper, Aeronca, and Luscombe [66]. A Cessna 195 fitted with full-length Plexiglass doors and floats has been

extensively used for experimental work [76]. Planes fitted with floats have also been used extensively in Canada, owing to the scarcity of landing strips and abundance of lakes. Surveying in Ontario in recent years has been done principally with the Norseman, De Havilland Beaver, and Seebee.

4. APPLICATION OF INSECTICIDES

Techniques of applying insecticides to forests by aircraft are governed by the choice of insecticide and formulation, which in turn must be suited to the aerial method. The insecticide must be highly toxic to the pest and it should preferably be selective, or relatively non-toxic to beneficial insects; low toxicity to mammals and other forms of life is also of particular importance. It should lend itself to formulation with solvents or diluents at high concentration so that low doses can be used. The formulation must be non-toxic to plants at the effective dose. Its physical properties, such as viscosity, specific gravity, and volatility, should favour the formation of a cloud of relatively uniform drops or particles that will settle rapidly with a minimum loss from evaporation or drift; at the same time they must be of a size that will give good coverage and must adhere well to the foliage if they are to act as stomach poisons or have a residual effect.

The choice of aircraft depends on availability and landing facilities, but will be governed by topography, carrying capacity, and manoeuvrability. They should be suited to flying at uniform low levels with a maximum of safety over the terrain involved. Dispersal equipment must be of a type that will give a dust or spray cloud of the particle or drop size desired, at a constant rate of emission. It should be easily adjustable for calibration.

The following is a summary of techniques used and problems involved, with emphasis on recent developments.

(A) DUSTING

In the earlier operations arsenicals were most commonly used, and their low solubility dictated their application as dusts mixed with an inert material such as talc. This method was subsequently employed with a number of other insecticides, including rotenone, nicotine, cryolite and, in Europe, DDT [37]. Suspensions in water have also been tried but proved difficult to handle owing to clogging, or were considered too heavy for aerial work at the necessary dilutions.

Aerial dusting has been used extensively for certain agricultural pests where it is possible to fly close to the crop, but it has a number of disadvantages for most forest work. The irregular shape of the dust particles gives them high buoyancy, so that they are easily carried by air currents and a good deposit is obtained only under ideal weather conditions. They adhere poorly to foliage unless it is wet with dew and dries shortly afterwards. Attempts have been made to improve adherence by coating Pb arsenate particles with oil [70]. Dusts are also somewhat difficult to mix and disperse uniformly, and require more bulky equipment than concentrated solutions. Parallel tests with dusts and sprays have shown the latter to be more efficient and effective. In Europe, dusting with DDT in talc gave 75% mortality of the nun moth compared with 95 to 100% from spraying with an oil solution [135]. Nevertheless, a considerable number of successful dusting operations have been reported [37, 162] and the method is still used in Europe although it seems to have been abandoned for forest insect control in America.

Dusts are applied from a hopper equipped with a wind-driven or power-take-off agitator. A feed-control gate and a Venturi type of spreader are suspended below the fuselage [33]. Numerous variations of this basic apparatus have been employed [69, in 75, 88, 171].

(B) SPRAYING

Formulations. Although spraying has been tried with a number of insecticides, only DDT has been used extensively. Limited tests have been made with some of the new insecticides [38, 56] but so far none has proved as suitable for forest insect control. DDT is toxic to most insects at very light doses and its immediate contact effects are reinforced by further action as a stomach or residual poison. Its toxicity to mammals is low. It is relatively inexpensive and can be formulated to withstand storage at a wide range of temperatures [53, 64]. Its solubility in oil-miscible solvents permits formulations of high concentration with medium viscosity and surface tension, which in turn favour efficient flow in the spraying apparatus and break-up at the nozzles, as well as good spread and adherence on the leaf surface. Its insolubility in water increases resistance to weathering by rain, although it deteriorates with exposure. Prolonged residual effect is not necessarily desirable if it results in greater mortality to beneficial forms of life, but it adds to the efficiency of an insecticide against pests that are not fully exposed to immediate contact.

Water suspensions and emulsions of DDT have proved less effective than oil solutions [33, 49, 170]. A smaller proportion of the emitted dose reaches the trees, owing to the rapid evaporation of water droplets and resulting buoyancy. Reducing the vapour pressure by addition of glycol or salts might overcome this sufficiently to make emulsions practicable. The replacement of oil diluents with locally available water would decrease the cost of the formulation and allow somewhat larger amounts of liquid to be used without increasing cost.

The commonest formulation used in America has been DDT dissolved in an organic solvent such as xylene [13], Velsicol AR50 [13, 85], cyclohexanone [144], Picco Hi-Solv 473 [21], or benzene [135], and generally diluted with an oil of medium to low volatility such as No. 2 fuel oil [13], motor oil or kerosene [144], or diesel oil [61]. A combination of xylene and kerosene gave a reduced deposit owing to high evaporation [172]. The present authors suggest that low-volatility gas oils with a b.p. of approximately 700° F. would be more satisfactory diluents. The concentration generally used is 1 lb. of technical DDT in 1 gallon, or approximately 12·5% by weight per U.S. gallon and 10% per Imperial gallon. One lb. DDT/acre has been found sufficient for most defoliators. In New Brunswick, under circumstances described below, the dose has been reduced to ½ lb./acre.

In Jugoslavia, aerosols have been generated from 5 to 16·5% solutions of DDT by means of the exhaust gases of the aircraft. Very good results are reported from doses of 2·25 to 3·15 lb./acre [17, 104, 174]. Fine aerosols may be more lethal in terms of the deposited dose, and may possibly reduce somewhat the load of insecticide, but would seem to increase the problem of drift and the discrepancy between the amount of insecticide emitted and the amount deposited.

Aircraft. Many types of aircraft have been used. Choice has been partly determined by availability and cost. War-surplus Stearman trainer biplanes have been popular with the American aerial-spraying industry for these reasons and when fitted with a 450-h.p. engine have proved very suitable for forest spraying. They have been considered superior to other types in Jugoslavia [104]. With the growth of aerial spraying, the production of aircraft specially designed for the purpose should increase efficiency and reduce flying hazards.

Owing to the size of many forest operations, a large machine appears to have advantages in its greater pay-load and its ability to work at a longer distance from landing fields. The Douglas C47 has been used successfully for control and experimental purposes in America [39, 61, 85] and in Austria [135]. The Canco PBY amphibian was used in Canada [144], and the Ford Tri-motor in Oregon [164]. The smaller, single-motored plane with adequate h.p. has advantages, however, that generally more than outweigh its limited pay-load and range. It has lower operational costs, can use smaller and less expensive airstrips, and its superior manoeuvrability is of major importance. This permits better control of altitude above the trees with less risk, and allows contour flying and more accurate coverage, especially over hilly or mountainous country. The Stearman has demonstrated these advantages in Oregon and New Brunswick. The De Havilland Beaver has proved equally suitable, apart from its greater initial cost.

Helicopters have also been adapted for spraying, and areas as large as 11,000 acres have been treated [105]. Their ability to fly close to the trees and in steep ravines, and to land on a small area, are of particular advantage in some operations, but at present high initial and operating costs discourage their use. They have been described as superior for plantations and small areas [33, 91, 173], but a comparison of the Bell 47 B-3 helicopter with a fixed-wing Travelaire 4000 suggested that the Bell was somewhat less effective against the Spruce budworm over natural forest in Oregon [49]. The helicopter is suitable when heavy doses and complete coverage are required, as against Elm barkbeetles and other shade-tree insects [122].

Dispersal equipment. The equipment for carrying and dispersing the spray must give a uniform emission of the formulation and a proper break-up of the liquid at the normal flying speed of the aircraft. The tank should deliver the liquid to the outlets at constant pressure, which may be provided by a pump driven by the air stream or by a power take-off. The following methods of breaking up the liquid have been used:

(i) The "spinner disc" was an early device. Two 14-in. discs rotated by an air-driven propeller at 2500 r.p.m. received the spray at the centre. It flowed by centrifugal force to the edges, where it was sheared by the slip-stream [2]. With a xylene and fuel-oil formulation it delivered a drop spectrum of 100 μ mass median diameter. The chief disadvantage was expensive upkeep.

(ii) The "rotary brush" operates on similar principles with a steel wire brush in place of the discs. Drop size varies with the length of the wires and the speed of rotation [3].

(iii) Venturi spreaders consist of a fan-shaped "tube" with an air scoop facing into the slip-stream and fitted with vanes. Nozzles between the vanes feed the spray into the air stream [5]. They

permit the use of gravity flow, as the rate is kept even by the negative pressure in the tube [33]. They are available commercially for spraying or dusting but have not been widely used in forest work, although employed successfully against the Spruce budworm in Oregon.

(iv) A simple vertical discharge pipe has been used extensively for mosquito control but gives too variable results for forest spraying. A 4-in. pipe cut at an angle and protruding beyond the slip-stream gave an average emission rate of 3·7 gal./sec. with gravity feed [33]. The method can be used only with high-speed aircraft such as the Douglas C47 and is unreliable as to swath width and coverage.

(v) An air-blast spraying apparatus has been developed for use with helicopters [122].

(vi) The 'spray boom' is the most widely used. The liquid is delivered under pressure to a horizontal pipe, usually suspended below the wings and terminating just short of the wing tips. The pipe is fitted with nozzles spaced throughout its length and adjustable as to aperture or angle. It causes a drag on the aircraft, but if the pipe is streamlined in cross-section this can be reduced as much as 15 times [5], or wind resistance can be largely eliminated by placing the pipe inside the trailing edge of the wing, with nozzles protruding aft [33].

The spray boom system is somewhat difficult to install and the pipes and nozzles must be kept clean and adjusted, but its disadvantages are outweighed by the width of swath obtained and its adaptability to control of emission rate and drop size. These can be varied by altering the pressure in the tank and the nozzle angle or aperture. The size of the boom pipe is determined by the rate of flow desired. On small aircraft which emit up to 20 gal./min., a thin-walled pipe of $\frac{3}{4}$ to $1\frac{1}{2}$ in. diameter is used [5, 33, 89], the diameter increasing with the length of the boom to compensate for the drop of pressure as the distance from the pump increases. With larger planes, such as the C47, which may emit up to 100 gal./min., a streamlined pipe of $2\frac{1}{4}$ in. diameter has been used [4, 6].

The emission pattern is not of major importance in forest spraying since the form of the spray cloud when it reaches the trees is largely determined by the effects of air currents. Proper break-up, however, is essential, as it governs the size of the drops, which in turn will determine the capacity of the cloud to settle and at the same time give adequate coverage. This is influenced by the type of nozzle and its position. The nozzles should be below the boom and the apertures directed downwards in order to avoid streaming and contamination of the plane [8]. The drop-size spectrum can be varied by changing the direction in relation to the air stream. The size decreases as the nozzles are moved from a backward- to a forward-pointing position [172].

A wide variety of nozzles is used on spray booms. Forty-two Stearman aircraft mounting from 20 to 36 nozzles showed 4 types, with apertures ranging from $\frac{3}{32}$ to $\frac{6}{32}$ in. [55]. An experimental C47 mounted 48 nozzles with a 0·218-in. aperture [81]. Some booms have various nozzle apertures to give wide drop-size spectra.

Break-up is also influenced by the speed of the aircraft. The boom attachment has produced droplets of 125 to 180 μ at 60 to 100 m.p.h. with small planes, but at the speed of a helicopter the size increases to from 200 to 300 μ. A device by which the air from the cooling fan is used to atomize the spray and produce a spectrum of 40 to 60 μ has been described [122].

The following features are desirable in all systems: (*a*) Valves that can be quickly operated to jettison the insecticide in an emergency—these, indeed, should be compulsory. (*b*) Tanks baffled to minimize surge, thus improving manoeuvrability, and preferably mounted ahead of the pilot for safety reasons. (*c*) Nozzles fitted with positive shut-off valves to prevent dribbling over areas where contamination is undesirable; valves in the boom feed pipe are unsatisfactory.

Drop size. The efficiency of the spray cloud depends on its capacity to settle and to cover the foliage. Both depend on the range of size of its drops. Unfortunately, settling increases while coverage decreases with drop size, the optimum size representing a compromise between the two objectives. It may be said that the most efficient atomization of the spray is that which produces the greatest number of the smallest drops that will reach the trees and impinge on the foliage or insects. Although a good deal of work has been done on the analysis of drop spectra, the ideal drop-size range cannot be precisely defined.

Deposited drop sizes have been measured on a number of operations that were successful. The mass median diameter in a New Brunswick operation ranged from 150 to 300 μ [21]. In Ontario experiments the average mass median diameter was 240 μ and drop size ranged from 20 to 500 μ. A median of 180 μ has been recommended for agricultural spraying [14], but the higher altitudes of flight and the turbulent conditions encountered in forest spraying probably warrant a somewhat larger size.

A number of authors have presented data on drop size in relation to falling or drifting [5, 15, 33, 51 172], but there is little information on its relation to biological effectiveness. In experiments on the

Spruce budworm it was shown that there was no significant correlation between insect mortality and gallons per acre or drop size, but a strong correlation existed between mortality and number of drops per unit area when they ranged in size from 20 to 500 μ. A 50% mortality occurred with 2 drops/sq.cm., 95% with 12 drops, and 100% with 17 or more [85, 124]. This suggests that coverage or area contamination, as measured by the number of insecticide particles per unit area, is a more reliable criterion of effective dose than volume per acre. In some of the samples, complete mortality resulted from a deposit as low as 0·2 gal./acre. High mortality has resulted from drifting particles too small to be detected by the sampling methods used [7]. Minute drifting particles may extend the effectiveness of the cloud well beyond the measured swath width.

Drop size is of prime importance in applying sprays thoroughly but economically. The volume of a drop is a function of the cube of its diameter, so that if, for instance, the diameter is doubled, its volume is increased 8 times. For a given mass median diameter, 30% of the mass may be represented by 4% of the drops in the larger sizes and 7% of the mass by 40% of the drops at the small end of the spectrum [139]. Development of spraying apparatus should be in the direction of narrowing the spectrum, chiefly by eliminating the larger sizes to prevent waste. Oil drops $< 50\,\mu$, however, fall very slowly and will drift indefinitely in turbulent air. A spectrum ranging below 250 μ would appear to be most efficient within the usual specified spraying conditions. It should be noted that it is neither possible nor desirable to obtain absolute uniformity of size. This would narrow the width of the swath and increase the danger of leaving unsprayed strips, owing to unavoidable inaccuracies in flying or changes in air movement. It is the drift of the smaller drops that provides the amount of overlap necessary for good coverage of the forest.

Evaporation. Part of the volume of a formulation is lost by evaporation of the drops as they fall. This may also reduce the amount of insecticide deposited, by raising the buoyancy of the cloud. As water is more volatile than oil, this is one reason why aqueous suspensions and emulsions have been little used.

Replacement of a highly volatile solution (xylene/kerosene) with a less volatile oil increased the mass median diameter of the deposit from 193 to 300 μ and the % recovery from 51 to 71 [172]. Evaporation losses vary greatly with the solvent. Studies in East Africa showed that with an aircraft height of 30 ft. and a mass median diameter of 80 μ the loss from evaporation was 50% with kerosene and diesoline, 70% with kerosene and furnace oil, and too small to measure when lubricating oils (SAE 20) were used [169]. Loss would be greater at the greater height flown in most forest operations, especially under conditions of air turbulence. It is greatest in the small drop sizes owing to their larger surface in proportion to volume and their longer time of falling. The loss of particles of insecticide in this way is probably more serious than the loss of volume.

Evaporation complicates deposit measurement. Drop spectra and deposit volumes have been measured by catching the drops on absorbent and non-absorbent surfaces and measuring their size with a microscope or camera, or their total volume by colorimetric methods. The original size of the drops and rates of evaporation during fall and after impingement are not known. A device for generating drops of predetermined size has been developed and should aid in the study of this problem [127]. Toxicological studies are also complicated by lack of knowledge of evaporation and of the actual concentration of the insecticide when it reaches the insect. Laboratory tests of a solution have indicated much lower toxicity than the same solution when applied from aircraft [85].

Meteorological factors. Air movements are of major importance in determining the efficiency of aerial spraying, and most studies of meteorological factors have been concerned with the effects of wind and thermal currents.

The effect of wind is to separate the drop sizes and deposit them in decreasing sizes at increasing distances down-wind [7, 85]. It has been calculated that in a 3-m.p.h. wind a drop of 33 μ will take 15·5 minutes to fall 100 ft. and will drift 1360 yards, while drops of 100, 200, and 500 μ drift 160, 62, and 23 yards, respectively [32, 33]. These figures, however, ignore effects of evaporation and turbulence, which can greatly increase the distances or prevent deposition of the smaller drops. In a dead calm the large drops tend to fall vertically while the smaller drops are carried to each side of the flight line by the turbulence caused by the aircraft, in a swath wider than the wing-spread [172]. The Stearman, with a boom of 24 ft. and flying at 100 ft. upwind, gave an average 'effective' swath width of 160 ft. [55]; with a boom of 26 ft. at a height of 6 ft., the swath was 120 ft. wide [33].

The amount of wind that can be tolerated depends on so many factors that it cannot be easily determined. A limit of 8 m.p.h. has been suggested for forest spraying [173], but it may be possible to obtain satisfactory results with speeds up to 10 or 12 m.p.h. in the absence of thermal turbulence. Speeds as high as 20 m.p.h. have been suggested but will probably prove excessive for forest work [33].

Wind may be used to aid in the even distribution of the spray by flying cross-wind [1] and varying the altitude with the speed of the wind [74, 170]. The components may be calculated as HU where H is the height of the aircraft and U the cross-wind in terms of wind speed and the cosine of its angle with the perpendicular to the flight line. With a cross-wind component of 3 m.p.h. and an altitude of 200 ft., HU is 600; with 6 m.p.h. a similar deposit pattern would be obtained at an altitude of 100 ft.

The deposit may be less on the down-wind side of trees by as much as 50%, and this has been associated with a significant difference in mortality [85]—a factor to be considered when measuring and calculating dosages.

Maximum deposit and accurate placing of the spray are favoured by low wind and an absence of atmospheric turbulence. Thermal turbulence, caused by the warming of the ground by the sun, results in the spray being carried upwards and will generally limit spraying to the early morning and evening, except on calm, cloudy days. It is related to the vertical temperature gradient [30]. The air is most stable when the temperature near the ground is lower than at higher levels—'inversion' as opposed to 'lapse'. Measurement of temperature differences at heights of 1 and 2 m. has been found to be a satisfactory indication of the gradient at higher levels. The ratio of wind speed at the two levels may also be used as an indication of turbulence. When the temperature gradient is zero this ratio averages 1·14 and it may range from 1·08 with high lapse to 1·40 with high inversion [30, 33]. These relationships were calculated on open terrain and have been used in forest spraying [85] but it is doubtful whether they are entirely applicable, and they should be investigated for forested areas. The air movements within the stand affect the proportion of the spray cloud that actually impinges on the insects or foliage. Several authors have discussed the complexities of the problem and it has been suggested that an adequate measure of turbulence may be calculated from temperature gradient and wind speed [30, 85, 169]. Large-scale operations have shown that observation of the behaviour of the spray cloud from inspection aircraft is a practical method of determining when air conditions are unsuitable for spraying [160, 161].

Turbulence can result from wind in hilly country but the effects of terrain on spray deposit have not been sufficiently investigated. It has been noted that deposits were heavier on the brows of hills, on both upwind and downwind sides [85]. Flight patterns conforming to the contours give better control of altitude and greater uniformity of deposit, but the latter will always depend in large measure on the experience and skill of the pilot.

Other effects of meteorological conditions have not been much studied, as the overriding problem has been to secure an adequate, even deposit and make the fullest use of favourable weather during the most susceptible stage of the insect. The toxicity of some insecticides increases with temperature, and both temperature and humidity affect evaporation. These effects, however, have seldom been considered in the timing of spraying. Precipitation precludes spraying, and wetness of foliage after rain or dew may prevent adherence of the insecticide; spraying should not be done until dripping has ceased and conditions indicate progressive drying of the foliage.

Dosage. The required dose varies with the toxicity of the formulation to the pest, the drop size, and the degree of exposure of the insect stage treated. The latter may be influenced by the degree of defoliation. The Spruce budworm, for example, is more susceptible to DDT in the younger stages [87] but more exposed in the later stages. Exposure increases with degree of defoliation and decreasing vigour of shoot growth as determined by the cumulative effects of previous attack. Thus the effective dose may be less with a heavy infestation and in the later stages of an outbreak.

Dosage may be expressed as the amount used (the emitted dose) or the amount reaching the ground (the deposited dose), per unit area. Owing to the effects of drift, evaporation, and uneven application, the required emitted dose may be several times the effective deposited dose. Although a deposit of $\frac{1}{5}$ gallon/acre has proved effective against the budworm [85] an emitted dose of 1 gallon has generally been used.

The emitted dose can be calculated by dividing the total amount of insecticide used by the area treated. Assessment of the deposit on large operations has been made with varying degrees of accuracy by means of glass plates [49, 144] or papers [21, 46, 52, 53, 56] placed at intervals across sprayed areas to indicate whether areas have been adequately treated. Precise assessment involves measurement of the number and size of drops per unit area and the concentration of insecticide in the deposited liquid. Methods have not yet been perfected. Glass plates coated with an oleophobe have been used and the drops measured and counted by means of projected photographs [45]. The mass of the lens formed by a drop can be calculated by measuring its focal length and the contact angle with the glass; or if plates are coated with MgO, craters are formed that bear a direct relationship to drop size [106]. Dyed sprays have been collected on absorbent paper [85, 86], and undyed sprays on paper impregnated

with an oil-soluble dye [44]; the papers must have a uniformly absorbent surface and be calibrated for relation between drop and stain diameters. Dyed spray may also be taken on glass or metal plates, washed off with a measured solvent and assessed colorimetrically [33, 44, 85, 169]. Undyed spray may be taken in the same way and analysed chemically [33, 172].

These methods fail to measure the effects of evaporation on drop size and on concentration of the insecticide. In the colorimetric method fading of the dye is a source of error. The errors increase as the size of the drops decreases, and failure to measure the very fine drops or particles that exercise the greatest insecticidal effect in proportion to their size is a serious weakness. Chemical analysis is probably the most precise but is too complicated for extensive operations. In experimental work, simultaneous use of the different methods has provided data from which total evaporation can be estimated [169] but they have failed to show close correlation of results [85].

Flight control. Suitable aircraft and experienced pilots are essential if uniform coverage of large forested areas is to be obtained with economy and safety. Problems of organization will be discussed below. It is important that responsibilities for timing and supervision of spraying be clearly defined and a system of observing and controlling flight, with the necessary wireless communication, be devised.

Minimum spray-pattern specifications should be set and each aircraft calibrated for emission rate, break-up, and swath width. Calibration of Stearmans has been carried out at 100 ft. above an airstrip, flying upwind at 100 m.p.h. The emission rate was set at 20 gal./min. to give 1 gal./acre with a flight interval of 100 ft. The 'effective swath width' was defined as that giving a minimum deposit of 0·2 gal./acre. Swath width of a large number of planes ranged from 120 to 210 ft. with an average drop size of 150 to 300 μ [21]. Calibration was effected by changing the number of nozzles or sizes of apertures. Experiments with pairs of aeroplanes flying in echelon indicated that an interval of 250 ft. between planes and an interval of 150 ft. between the double swaths gave uniform coverage at an average of $\frac{1}{2}$ gal./acre [55]. Experiments with the larger C47 indicated that at 150 m.p.h. with an emission of 60 gal./min. the effective swath width was 200 yards at *HU* 800, and the flight interval was set at 150 yards to ensure adequate overlap [85].

This measurement of 'effective swath width' gives only an indication of aircraft performance and may bear little relation to actual width in the varying air conditions under which the control operation is carried out. Overlapping is very great with cross-winds, and an effective dose, as measured by number of drops, may be laid down at much greater distances from the flight line than indicated by the measured swath width. This overlap is necessary in order to avoid gaps due to changing wind speed and direction and to obtain a reasonably uniform distribution of different drop sizes.

Navigation control is difficult in most forest work. Landmarks may be few and the setting up of special markers impracticable. A skilled pilot, however, when provided with good maps or photographs and given an opportunity to familiarize himself with his spray block, can generally maintain satisfactory intervals and direction, using topographical boundaries such as streams and heights of land. With the smaller planes, rapid turning permits observation of the previous spray cloud [167] and the flying of aircraft in pairs assists greatly in maintaining the correct flight interval [65]. Inspection by observation planes with radio communication is necessary in large operations.

The height above the trees is determined by topography and considerations of safety, and must be the responsibility of the pilot. One hundred feet is commonly set as the objective. Fifty feet will give better results when there is wind, but in rough terrain some spraying may have to be done at 200 or more feet. Satisfactory results have been reported at heights up to 400 ft. under favourable conditions [164, 170].

Accurate flight control is necessary in experimental work and has been more or less achieved by various ingenious methods of marking, such as balloons [144, 172], smoke pistols and coloured cloth markers [85], mirrors [11], and painting the top of trees by means of explosive cans of paint [61]. Altitude has been controlled by radio altimeter and flight paths have been measured with theodolites [85]. Even with these methods it is not always easy for pilots to lay down the swath exactly as prescribed.

To be continued.

ABSTRACT SECTION

0. FORESTS, FORESTRY, AND THE UTILIZATION OF FOREST PRODUCTS: GENERAL

For general *regional* accounts see section 90

TRANSLATIONS

See Nos. 4163, 4554, 4590.

0 (038). DICTIONARIES

3710. SIMONEN, M. Skogslexikon: Svenska–Engelska–Tyska–Franska. **[Forestry dictionary: Swedish–English–German–French.]** Svenska Skogsvårdsföreningens Förlag, Regeringsgatan 18, Stockholm. 1954. pp. 284. 23 refs. Price *Kr.*35.

Gives, in parallel columns, the translations of 2616 Swedish terms (arranged and numbered in their Swedish alphabetical order, with separate indexes to English, German and French words). In some difficult cases, e.g. especially for terms relating to work studies, a definition has been added in all four languages. The dictionary is intended to meet the needs of the practical forester and therefore includes a fair number of non-technical words.

0 (048.1). BIBLIOGRAPHICAL LISTS

See Nos. 3823, 4449–50, 4525–6, 4629, 4644, 4717, 4742, 4778, 4783.

0 (05). PERIODICALS. YEARBOOKS. DIRECTORIES. ALMANACS, CALENDARS, DIARIES

See also No. 3775.

3711. ***Erdészeti Kutatások.*** Erdészeti Tudományos Intézet, Budapest.

The first number of this series ['Forest Researches'] was published in 1954. It consists of 92 pages and contains 6 original articles in Hungarian with Russian, English and German summaries. Citation in *For. Abstr.*: *Erdész. Kutatás., Budapest.*

3712. ***Referativnyi Žurnal: Biologija.*** Izdateljstvo Akademii Nauk SSSR, Moskva. Semimonthly. Price *Roubles* 360 yearly (*Roubles* 15 per copy). H.S.B.

Started publication Jan. 1954. To contain ca. 2000 classified abstracts per issue. Each issue includes an author index. Citation in *For. Abstr.*: *Referat. Ž.* (*Biol.*).

3713. ***Norsk Skogbruk.*** Det norske Skogselskap, Oslo. Monthly.

Incorporates *Skogbrukeren.* No. 1, April 1955, contains articles on local problems and an extract from *Medd. norske Skogforsøksv.* No. 44, 1954. Citation in *For. Abstr.*: *Norsk Skogbr.*

3714. ***Dansk Dendrologisk Årsskrift.*** Dansk Dendrologisk Forening, Copenhagen.

Irregular (Vols. 1–3 appeared in 1950, 1953 and 1955). Not sold commercially, but copies may be purchased, if available, from members of the association, price Kr.15 per issue. In vols. 2 and 3 the longer articles have English summaries. Citation in *For. Abstr.*: *Dansk dendrol. Årsskr.*

3715. ***Forest Science: a Quarterly Journal of Research and Technical Progress.*** Society of American Foresters, Washington. Quarterly. Price $6·00 p.a. or $2·00 per copy.

Vol. 1 (No. 1), 1955, contains 80 pages. The journal is primarily intended to report the results of original investigations. Citation in *For. Abstr.*: *For. Sci.*

3716. ***Forest Products Journal.*** Forest Products Research Society, Madison, Wisconsin. 2-monthly. Price $15·00 p.a.

Formerly *Journal of the Forest Products Research Society.* The first number with the new title (Vol. 5, No. 1) was issued in Feb. 1955. Citation in *For. Abstr.*: *For. Prod. J.*

0 (084.3/.4). MAPS. ATLASES

3717. Weltforstatlas. **[World forestry atlas** [part].] Fritz Haller Verlag, Berlin. 1954.

[Cf. *For. Abstr.* 15 (No. 3172).] Further map sheets, as follows:—Baltic republics (forest distribution; scale 1:1,000,000); Japan (forest distribution; scale 1:3,000,000); Japan (percentage forest area; percentages of coniferous and broadleaved forest, and of high forest and coppice; growing stock and annual increment per ha.).

0 - - 011. TERMINOLOGY. NOMENCLATURE

See Nos. 3710, 3816, 3822, 3828, 3833, 4205, 4293, 4738.

1. FACTORS OF THE ENVIRONMENT. BIOLOGY

3718. WOHLFARTH, E. Waldkunde. Erster Teil: Von dem Wesen und der Soziologie des Waldes. **[The natural science of the forest as an organic whole. Pt. I: Nature and sociology of the forest.]** J. D. Sauerländer's Verlag, Frankfurt a.M. 1953. pp. 130. 123 refs. [G.]

This work, to be followed by two more parts which will deal with the 'biology and ecology' [chiefly autecology and site factors?] and the 'distribution and development (history)' of the forest, is an essay in the theory and principles of a subject that is seen by the author as wider and yet more closely integrated than the usual 'foundations of silviculture'. The central notion is that of the forest as an organic whole transcending the sum of its five parts, viz. the tree stand, the remainder of the flora, the fauna, the forest soil and the internal forest climate. Much space is given to discussion

of past and proposed terminology in relation to the systematic arrangement adopted and the description of the characters and phenomena that have been or should be the object of study, and there are many illustrative diagrams. Examples, where given, are of Central European conditions. The chief sections deal with the nature of forest as an entity and the sociology of the forest, the latter including chapters on: the stand as the unit; 'typological sociology' (the analysis and description of stand composition and constitution, ground flora, fauna, soil, internal microclimate and forest types, as static phenomena) —a chapter which makes up the bulk of the book; and 'kinetic sociology' (the same components seen from the point of view of temporal and spatial development). The references are almost all to German literature.

3719. Werneck, H. L. Die naturgesetzlichen Grundlagen des Pflanzen- und Waldbaues in Oberösterreich: Versuch zu einer Raumordnung von Standort, natürlicher Pflanzendecke, Kultur- und Nutzpflanzen auf der Grundlage von Pflanzengeographie und -ökologie in Oberösterreich. **[The natural foundations of plant cultivation and silviculture in Upper Austria: an essay in the classification of site, natural plant cover, cultivated and useful plants on the basis of plant geography and ecology.]** O.-Ö. Landesverlag Wels. 2nd ed. (rev.) 1950. pp. 358 + 48 plates (maps and photos). 31 pp. of refs. [G.] (*Schriftenreihe der O.-Ö. Landesbaudirektion* No. 8.) Price [£1. 0*s*. 1*d*.]

3720. Werneck, H. L. Die naturgesetzlichen Grundlagen des Pflanzen- und Waldbaues in Niederösterreich: Versuch zu einer Raumordnung von Standort, natürlicher Pflanzendecke, Kultur- und Nutzpflanzen auf der Grundlage von Pflanzengeographie und -ökologie in Niederösterreich. **[The natural foundations of plant cultivation and silviculture in Lower Austria: an essay in the classification of site, natural plant cover, cultivated and useful plants on the basis of plant geography and ecology.]** Verein für Landeskunde von Niederösterreich und Wien, Vienna. 1953. pp. viii + 332 + 20 plates (maps). 26 pp. of refs. [G.] (*Forschungen zur Landeskunde von Niederösterreich* Vol. 7). Price [8*s*. 3*d*.]

11. SITE FACTORS: CLIMATE, SITUATION, SOIL, HYDROLOGY (WATER AND SOIL CONSERVATION)

111. *The Atmosphere. Meteorology. Climate and Microclimate*

111.7. Humidity, Evaporation. Clouds etc. Precipitation

See also section 116 and Nos. 4178, 4181.

3721. Papp, L. A csapadékjelentö szolgálat 1952. évi adatainak értekelése. **[Evaluation of [Hungary's] precipitation records for 1952.]** *Erdész. Tud. Int. Évk.* 2, 1952 (1954), (5–33). 3 refs. [Hu.russ. e.g.]

A detailed analysis of the data from the 250 rain-gauge stations now maintained by the Institute of Forest Sciences, compared with the Hungarian Meteorological Institute's records for the past 40 years, along with a tentative correlation of the regional, monthly precipitation in the 1951–52 crop year with the success (survival) in new plantations.

3722. Krick, I. B. **The value of weather modification operation to the pulp and paper industries.** *Pulp Paper Mag. Can.* 56 (3), 1955 (263–74, 297). 16 refs.

Illustrated by the analysis of 3 projects (Canada, U.S.A. and Spain) with some notes on lightning suppression.

111.8. Climatology. Climate and Microclimate

See also Nos. 3901, 4003, 4057, 4100–3, 4178, 4181, 4403–6.

3723. Sparkes, C. H., and Buell, M. F. **Microclimatological features of an old field and an Oak-Hickory forest in New Jersey.** *Ecology* 36 (2), 1955 (363–4). 6 refs.

Weekly readings of maximum and minimum thermometers taken in a mature Oak/Hickory wood and in two habitats in an old field abandoned for 40 years, a grassy opening, and a small thicket of young trees and large shrubs, show pronounced annual and seasonal temperature differences between themselves and between them and the local Weather Bureau station. Records taken at 5-cm., 20-cm. and 2-m. levels as well as 4 cm. below ground show also that, within these habitats, microclimatic structure from season to season is very different from one to another. *Author's summary.*

3724. Papp, L. Adatok a futóhomok mikroklímájához. **[Contributions to the microclimate of shifting sand soils.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (113–23). [Hu.russ.e.g.]

A detailed hour-by-hour study for 24 hours (31 July–1 Aug.) of air and soil temperature, relative air humidity, evaporation, and soil moisture content at two stations in the Illancs experimental area, one recently stabilized by straw mulch, rye sowing and windbreaks, the other near by on the bare top of a sand dune. The data are compared in graphs and tables.

3725. Chroust, L. Vliv výchovy mlazin na mikroklima porostu. **[Effect of tending of young stands on their microclimate.]** *Lesn. Práce* 33 (12), 1954 (532–9). [Cz.]

Short-term summer measurements of temperature and air humidity conducted in 3 experimental plots (two near Opočno in Czechoslovakia, ca. 300–350 m. alt., of pure, natural Oak ca. 20 years old, one being on a steep slope; the third plot near Česky Krumlov, alt. 650–950 m., Beech and Fir, 10–30 years old) show that: (1) untended young stands, with height differentiation, enjoy a relatively cool growing space; (2) thinnings from below which hardly disturb the canopy, increase the air temperature between canopy and soil, at the same time reducing the air humidity, which causes the soil surface to become dry; (3) crown thinnings which aim at increasing height differentiation, result in a simultaneous increase of both temperature and absolute air humidity, so that the soil does not dry out.

114. *Soil. Soil Science*

114.1. Soil Physics

See also Nos. 3744, 4199–4200, 4398, 4401.

3726. George, J. M. **The use of gypsum block soil moisture units.** *Aust. For.* 18 (2), 1954 (62–5).

Discusses the technique adopted at Mt. Burr in the use of gypsum blocks, and summarizes results to date. Soils in areas that exhibited severe 'dead top' of *Pinus radiata* have been shown to dry out quickly and to remain at m.c. < wilting point for long periods in late summer and autumn. There is some evidence that soils on areas of high site quality have more available moisture for longer periods than some poorer sites.

3727. Puri, G. S. **Soil climate of some Indian forests.** *J. Indian bot. Soc.* 33 (4), 1954 (394–416). 76 refs. O.B.D.

A study was made of soil moisture, organic matter, 'relative humidity' (i.e. soil moisture/organic matter), temperature, pH, and exchangeable Ca in plantations of Chir [*Pinus longifolia*], Sal [*Shorea robusta*] and Teak in the New Forest, Dehra Dun, and in a grassy area in the open, during the dry summer, monsoon rain, dry winter, and rainy winter periods. Considerable variations were found during the different seasons and at various soil depths. There were indications of the existence of a relationship between pH, Ca content, temperature and soil 'r.h.' and the tree cover, but data were insufficient to elucidate this. Lowest pH values were found under Sal and highest under Teak. Variations in soil Ca with depth seemed to be related to rainfall and temperature as well as to vegetation. During hot weather, surface soils had a higher Ca content, but at a depth of 6 in. Ca contents were usually lower in hot than in cooler weather. On the whole, Ca contents in all plantations were highest during the dry periods and lowest during the rainy winter period. In general, lower temperatures at all depths were found in hot weather under Teak and Sal, and higher temperatures during the winter period under Sal. Soils in the open showed greater fluctuations in soil temperature and soil r.h. than those under forest. *From author's summary.*

3728. Coutts, J. R. H. **Soil temperatures in an afforested area in Aberdeenshire.** *Quart. J. R. met. Soc.* 81 (347), 1955 (72–9). 16 refs. E.M.B.

Presents some data collected since Jan. 1952 in a forest plantation near Ballater. The following conclusions were drawn: (1) mean annual temperatures are practically the same throughout the soil profile, (2) inversions of the temperature profile occur in April and Aug., (3) frost-free periods were June–Sept. in the air, and May–Oct. in the soil at a depth of 1 in. Freezing at a depth of 6 in. was restricted to the months of Dec. and Jan. and none was recorded at depths of 12 in. or more. During 1952 and 1953 temperatures of 0° C. or less were noted on 167 days in the air, 109 days at a depth of 1 in., and 12 days at 6 in. There is severe damping of temperature amplitudes with increasing depth, the diurnal variations being very small at depths > 12 in. Good estimates of weekly mean temperatures can be obtained from readings of the daily maximum and minimum temperatures. *From author's summary.*

114.2. Soil Chemistry

See also Nos. 3727, 3737, 4199–4200, 4401.

3729. Dolgov, S. I., and Markovskiĭ, V. N. Bystryĭ sposob opredelenija zasolennosti počv i gruntovyh vod. **[Rapid method of determining the salt content of soils and of groundwater.]** *Lesn. Hoz.* 5 (9), 1952 (83–7). [Russ.]

A new electrical apparatus devised by Markovskiĭ has the advantage of using D.C. instead of A.C. for determining the electrical conductivity and concentration of salt solutions; figures giving the latter for a range of temperatures, with an accuracy sufficient for practical purposes, are read direct from a table, without the need for complicated calculations; the construction of the apparatus is simple, and its light weight—1·5 kg.—renders it useful for field work.

3730. Cecconi, S., and Tellini, M. Ripartizione di acidi umici e fulvici in tipi diversi di terreno. **[The distribution of humic and fulvic acids in different soil types.]** *Ital. for. mont.* 10 (1), 1955 (32–5). 8. refs. [It.it.f.]

Describes a rapid spectrographic method of determining whether humic or fulvic acids prevail in a soil sample. Examination of numerous samples from different soil types confirmed that humic acids predominate in mineral soils rich in Ca or with a high degree of base saturation. Fulvic acids on the contrary, prevail in acid soils or those poor in Ca, and represent the more mobile fraction of the organic substance in the soil profile, the relative amount of these acids increasing with increasing depth.

114.3. Soil Formation. The Soil Profile and its Development. Litter, Humus etc.

See also Nos. 4397–9.

3731. Tonnard, V. La pédogénèse dans la forêt de Saint-Michel. **[Soil genesis in the forest of Saint-Michel.]** *Bull. Inst. agron. Gembloux* 23 (1), 1955 (66–89 + 9 photos). [F.f.e.g.] E.M.B.

Observations were made in this area of the Ardennes on the morphology, mineralogy and geological origins of soils, and the influence of man, vegetation, and climate on their formation. The process of degradation in the worst parts dated from the second half of the 18th century and has been aggravated by the presence of Beech. The horizontal roots of this and of Spruce (introduced ca. 100 years ago) have favoured the formation of 2 superimposed profiles of different origin. Planting of Spruce, far from drying up any swampy patches, has allowed the water-table to rise. *From author's summary.*

3732. Boschi, V., and Vicini, C. I terreni del comprensorio dell' ex-bosco della Saliceta nel comune di Camposanto (Modena). **[The soils of the former Saliceta Wood in the commune of Camposanto,**

Modena.] *Ann. Sper. agr.* (*n.s.*) 9 (3), 1955 (CXXI–CXLVI + 1 tbl. + 10 maps). 8 refs. [It.it.e.] C.G.B.

Gives detailed analytical data in a table and 10 pedological maps, of the soils of this 1000-year-old wood, recently cleared for agriculture. It consisted of some 500 ha. of Ash, Elm and Oak coppice, with 10–15 standards/ha. The long period of woody vegetation appears not to have impoverished the mineral content of the soil, but neither has it enriched the N and organic content, doubtless because of the regular removal of litter.

3733. Blow, F. E. **Quantity and hydrologic characteristics of litter under upland Oak forests in Eastern Tennessee.** *J. For.* 53 (3), 1955 (190–5). 52 refs.

Gives statistically based sample data from a 2- to 5-year study of a *Pinus echinata*, a *Liriodendron tulipifera*, and 5 upland Oak stands, for total litter (field weight) against mensurational data. Depending on the fire history, cutting practice and stand composition, this weight varied from 2 to 12 tons/acre. For each species of a stand consisting of 6 Oaks and 6 other species, the oven-dry weight of the foliage in June, Aug., and Oct. of 2 years, and the leaf-fall in % of the first year's foliage, in Aug., Oct., and Dec. are shown. In one stand, annual leaf-fall added 1·3 tons, bringing the litter peak to 5·4 tons (Dec.), which declined to 4·2 tons (Aug.). The % moisture content is shown against number of days since the last rain $\geqslant 0{\cdot}25$ in. Field capacity of hardwood litter averaged 135%, rose after rain to 175, declined rapidly in 10 dry days to 41 and then slowly in 20 dry days to 25%, where it remained relatively steady.

3734. Častuhin, V. Ja., and Nikolaevskaja, M. A. Issledovanija po razloženiju organičeskih ostatkov pod vlijaniem gribov i bakterií v dubravah, stepjah i polezaščitnyh polosah. **[Studies on the decomposition of organic residues under the influence of fungi and bacteria in the Oak woods [of the Voronezh Nature Reserve], steppes and shelterbelts [on the Kamennaya Steppe].]** *Trudy Botaničeskogo Instituta Akademii Nauk SSSR, Ser. 2*, No. 8, 1953 (201–326). [Russ.] From *abstr.* in *Referat. Ž.* (*Biol.*) 1954 (1), (No. 293). [Russ.] H.S.B.

Covers: (1) Decay of Oak wood, citing *Armillaria mellea* as causing widespread mortality, *Daedalea quercina* and *Polystictus versicolor* as important in the main breakdown of the lignocellulose complex, and *Mycena* spp. and *Hypholoma sublateritium* as characteristic of the 'red-rot' stage in which decomposition is completed. It is stated that the species involved in decay depend to a considerable extent upon the particular species responsible for the death of the tree. (2) Oak litter decomposition, including pure-culture studies of some of the many species isolated, using special flasks making it possible periodically to remove metabolic products and to moisten the substrate. *Collybia bryophila* and *Marasmius ambrosaceus*, the most vigorous in decomposing leaf substance, caused weight losses of 40–70%. Moulds caused weight losses of $\nearrow$ 31–32% and are regarded as not very important in the decomposition of hardwood leaf-litter.

3735. Zemljanickiĭ, L. T. Količestvo i zoljnyĭ sostav listovogo opada v iskusstvennyh lesnyh nasaždenijah zony kaštanovyh počv. **[Quantity and ash composition of litter in artificial forest plantations in the zone of chestnut soils.]** *Počvoved.* 1954 (12), (30–5). 9 refs. [Russ.] A.P.B.

From small-scale preliminary studies at Zavetnoe (Ergeni Hills) and Kamyshin (Volga uplands) in 1949 and 1950, in which all the foliage was collected at the start of leaf-fall from 14 deciduous tree and shrub species [intensity of sampling not stated], it is calculated that a 17-year shelterbelt of *Quercus robur*/*Fraxinus pennsylvanica*/*Rhus cotinus*/*Lonicera tatarica*/*Ligustrum* sp./*Elaeagnus angustifolia*, on a light-chestnut, feebly saline clay-loam soil, should have a leaf-fall of ca. 3 metric tons (air-dry weight)/ha./year. Figures for individual species are tabulated and it is noted that a drought year reduces the weight of foliage. The actual litter on the ground at 17 years amounts to ca. 6·8 tons/ha. or 400 kg./ha./year. As ca. $\frac{1}{3}$ of the falling leaves are blown away, 2 tons/ha. remain to form litter and it is probable that ca. 1·5 tons/ha. of leaves are decomposed annually.

Figures are also tabulated for the ash constituents of autumn leaves of 18 deciduous woody species in 7- to 26-year-old shelterbelts at Zavetnoe and at Krasnoarmeisk (Sal'sk steppe). These show crude total ash values $> 10\%$ (based on oven-dry weight) in *Robinia pseudoacacia*, *Caragana arborescens*, *Amorpha fruticosa*, *Gleditsia triacanthos*, *Ulmus* spp., *Acer* spp., *Elaeagnus angustifolia* and *Tamarix* sp., and minimum values (ca. 7%) in *Q. robur* and *Acer tataricum*. High SiO_2 contents (3–7%) are noted for *Ulmus laevis*, *U. parvifolia*, *Acer platanoides* and *A. negundo*. Ca was highest (mostly $> 3\%$) in Leguminosae and *A. negundo*, and rather high in the *Ulmus* spp., *A. platanoides* and *E. angustifolia*. Mg varied little, but was high (1·2%) in *Tamarix* sp., which also showed high SO_4 (4·4%) and Cl (1·8%) and may therefore encourage salinity if grown long on these soils [cf. *For. Abstr.* 16 (No. 3842)]. *R. pseudoacacia* showed high N and SO_4 contents (1·8 and 0·5% respectively), and N was also high in leaves of *Q. robur*, *R. cotinus* and *C. arborescens*.

3736. Wilde, S. A. **Forest humus: its genetic classification.** *Repr.* from *Transactions of the Wisconsin Academy of Sciences, Arts and Letters, Madison* 43, 1954 (137–63). 72 refs.

The author first reviews past attempts at classification of humus types, with references to the literature. He concludes that the basically correct approach is by an analysis of the underlying causes of humus formation and establishment of the major genetic types of humus development rather than by empirical descriptions of different kinds of humus layers. He proposes a classification based on: (1) three fractions (ecto-humus, endo-humus, crypto-humus); (2) two distinct forms of humus layers, largely the result of climatic conditions (megorganic layers and oligorganic layers); and (3) genetic groups (foliogenous, rhizogenous, zoogenous, microbiotic, mycelial, and saprogenous). The following major types of humus development

are described: velum (litter), felt, crypto-mull, microbiotic mull, earthworm mull, arthropod mull, sward or root mull, fen mull, duff mull or amphimorph, lichen mor, root mor, mycelial mor or lignomycelial mor, and moss mor.

3737. Hoore, J. d'. L'accumulation des sesquioxydes libres dans les sols tropicaux. **[The accumulation of free sesquioxides in tropical soils.]** *Publ. Inst. nat. Étude agron. Congo belge* (*Sér. sci.*) No. 62, 1954. pp. 132 + 37 photos. 99 refs. [F.]

A detailed study, carried out in the Belgian Congo and West Africa, from which field examples are illustrated with many photographs and diagrams. Chapters cover: a classification of soil constituents based on potential mobility; the techniques used; the accumulation of free sesquioxides; the process of accumulation, induration and baring by erosion; and a genetical classification of accumulation zones (ancient and recent) with their properties and characteristics. The part played by vegetation is detailed. An immense 'cuirass' is at present being formed under rain forest in the lower parts of the Central Congo basin, from material derived from the basin rim.

3738. Lamotte, M., and Rougerie, G. Les cuirasses ferrugineuses allochtones: signification paléoclimatique et rapports avec la végétation. **[Ferruginous platforms formed by transport as indicators of ancient climates and their relation to vegetation.]** *C.R. Conf. int. Afr. Ouest, Abidjan 1953*, [1954] (89–90). [F.]

Summary of a paper in which general observations are clarified by the typical cases of the platforms flanking the quartzitic chains of Nimba and Simandon. These are 'poudingues' of re-cemented quartzitic debris lying unconformably on subhorizontal levels of erosion. Their date of origin and influence on the forest cover are discussed.

3739. Teichmann, J., and Schröder, H. Beitrag zur Kenntnis und Gliederung gleiartiger Standorte. **[Classification of gley-type sites.]** *Arch. Forstw.* 3 (1/2), 1954 (90–104). 5 refs. [G.]

Gley-type soils may show gleying in the upper or lower horizons. They have a compacted or indurated zone on which the rain or snow water is impeded or stagnates so that it is periodically soaked and thoroughly dried, in contrast to true gley soils, which are associated with perpetual groundwater. There is no enriched horizon as in podzols. Three profiles from forest stands in the Elbe basin (Wittenberg-Zerdst section) are described, with ground-flora tables. A classification, in extension of Scamoni's [see *For. Abstr.* 15 (No. 1209)] is offered, based on, (*A*) sites with gley-type alteration in the upper and lower soil proper, (*B*) sites with gley-type alteration in the subsoil. Sessile Oak, contrary to accepted views, is to be preferred as a chief stand element on all such soils in this area. Scots Pine, Weymouth Pine, Larch and Douglas Fir are suggested as accessories to Sessile Oak. Beech is only suitable for the slightly altered gley types. For moderately or strongly altered types Red Oak can be substituted. Hornbeam and Lime are useful as site-improving species; Poplar, Spruce and Aspen are unsuitable.

114.4. Soil Classification. Soil Types

See also Nos. 3739, 3870, 3927, 4057–8, 4061, 4063.

3740. Barry, T. A. **Some considerations affecting the classification of the bogs of Ireland and their peat.** *Irish For.* 11 (2), 1954 (48–64). 22 refs.

Paper presented to the International Peat Symposium, Dublin, July, 1954. [Cf. *For. Abstr.* 16 (No. 1358).]

3741. Dagnelie, P. Les sols forestiers de l'Ardenne—analyse statistique complémentaire—application de tests non-paramétriques. **[Forest soils of the Ardennes—complementary statistical analysis—application of non-parametric tests.]** *Bull. Inst. agron. Gembloux* 23 (2), 1955 (107–50). 21 refs. [F.] E.M.B.

A further statistical study, in 3 parts, of data already published [see *For. Abstr.* 15 (No. 3199)]: (1) comment on the previous study; (2) a study of the variabilities in the results of the statistical analysis; and (3) new applications of statistical tests to pedological problems.

3742. Dudal, R. Étude morphologique et génétique d'une séquence de sols sur limon loessique. **[A morphological and genetic study of a sequence of soils on loess silt loam.]** *Agricultura, Louvain* (*Sér. 2*) 1 (2), 1953 (119–63). 45 refs. [F.f.flem.e.g.] H.S.B.

Soils studied include those under Oak/Hornbeam (both degraded and normal) and under pure Beech.

3743. Nakata, I. **[Investigation of the forest soils in Hokkaido. III. Soil of the Atsuga national forest.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (9–13). [Jap.jap.e.]

Gives a description, with tables of soil data, of the soils under secondary broadleaved forest. One widely distributed type is evidently particularly suitable for *Fraxinus mandshurica* which grows everywhere on it. The soils are not too poor for *Abies mayriana.*

114.5. Soil Fertility. Soil Toxicity. Soil Depletion and Exhaustion

See also Nos. 3870, 3873, 3875, 3915, 4095–6, 4199–4200, 4397–4401.

3744. Fodor, G. Nyírségi és duna-tiszaközi tájak homokos talajainak termelési értéke. **[The productive capacity of sandy soils in the 'Nyírség' region and between the Danube and the Tisza.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (125–32). 4 refs. [Hu.russ.e.g.]

Soil-profile and root-system studies, particularly directed to wooded sites, show the hygroscopicity of sandy soils to be a reliable guide to the choice of tree species. In the calcareous soils between the Danube and Tisza, a minimum hygroscopicity of 0·3% is necessary for establishing continuous forest cover; with up to 0·5%, Austrian Pine and, in some places, Scots Pine and *Juniperus virginiana* can be planted.

3745. Mogg, A. O. D. **A preliminary note on the woody plants of the Witwatersrand region in relation to the geology and physiography.** *S. Afr. J. Sci.* 51 (10), 1955 (301–8). 7 refs. A.P.B.

A survey of 106 separate localities on 15 different geological formations resulted in lists totalling 240 species which, when certain classes of plant (rare, riverine, etc.) have been eliminated, fall into distinct natural groups highly characteristic of their rock class. *From author's summary.*

114.6. Soil Biology

See also Nos. 3734, 3877–83, 4199–4200, 4529.

3746. WAID, J. S. **Occurrence of aquatic hyphomycetes upon the root surfaces of Beech grown in woodland soils.** *Trans. Brit. mycol. Soc.* 37 (4), 1954 (420–1). 9 refs. O.B.D.

Clathrosphaerina zalewskii and *Varicosporium elodeae* were isolated from the root surfaces of Beech seedlings grown in Beech-wood soils, but not from the roots of seedlings grown in nursery soil.

3747. O'CONNOR, F. B. **Extraction of Enchytraeid worms from a coniferous forest soil.** *Nature, Lond.* 175 (4462), 1955 (815–6). 1 ref. [Dept. of Zoology, Univ. of N. Wales, Bangor.]

A technique has been devised by which heat is applied from above to soil spread out on a sieve resting in a funnel full of water. The worms present in the soil move downwards through the sieve into the funnel and can be drawn off. The method was used weekly for 6 months on samples from a pure stand of Douglas Fir, during which population densities varied from 11·2 to 25·7 per sq. cm., of which 90% occurred in the top 6 cm. of the profile.

116. *Hydrology. Soil and Water Conservation and Erosion*

See also Nos. 3733, 3927–8, 4096, 4161.

3748. MOUL, E. T., and BUELL, M. F. **Moss cover and rainfall interception in frequently burned sites in the New Jersey Pine barrens.** *Bull. Torrey bot. Cl.* 82 (3), 1955 (155–62). 11 refs. O.B.D.

Investigations were undertaken to study the rôle of bryophytes and lichens in rainfall interception. Under laboratory conditions, well-developed moss mats of the kind studied may, when air-dried, absorb an average of 0·62 in. of rainfall, ranging from 0·52 in. (*Dicranum*) to 0·68 (*Ceratodon* and *Leucobryum*); and well developed lichen mats from 0·15 in. to 0·28 in. depending on the species. Assuming that the mosses dry out completely between storms, they may intercept as much as 50% of the throughfall where they occur; lichens about half as much. Nevertheless, as an interceptor of precipitation, the bryophyte layer, even at its maximum, is probably never as important on an area basis as the thick, continuous litter layer of areas not subjected to prescribed burning. *From author's summary.*

3749. FLETCHER, H. C., and RICH, L. R. **Classifying Southwestern watersheds on the basis of water yields.** *J. For.* 53 (3), 1955 (196–202). 1 ref.

Using Thornthwaite's formula [*Geographical Review* 38 (1), 1948] for determining evapo-transpiration (ET) from precipitation (P) and temperature, with data on run-off and time of water use by vegetation, curves showing the course of ET and P through the year are drawn for low, medium and high yielding catchments in the Sierra Ancha Experimental Watersheds, Ariz. Similar curves are drawn for 23 stations in Arizona and New Mexico, the periods of surplus and deficient water and of soil-moisture use and recharge being shaded, and a map shows the high, medium and low water yielding areas in the 2 states. It is considered that only the first should be managed for increased water yield, the medium and low yielding areas being used for other production under protective vegetation that will control flood peaks and reduce sedimentation.

3750. GARCIA NAJERA, J. M. El bosque, el agua y la conservación del suelo—principios racionales de la influencia del monte en la escorrentia superficial. **[Forests, water and soil conservation—principles relating to the influence of the forest on surface run-off.]** *Comun. Inst. for. Invest. Exp. Madrid* No. 2, 1955. pp. 7 + 1 plate. [Span.]

Presents formulae for calculating the rate of run-off on (1) denuded and (2) afforested slopes, and describes laboratory experiments at the Madrid Institute illustrating some of the principles involved.

3751. NOGUCHI, Y. **[On problems of making a unit hydrograph.]** *Misc. Inform. Tokyo Univ. For.* No. 10, 1955 (55–68). 8 refs. [Jap.jap.e.]

In a preliminary study of the % distribution over time of the discharge in the Ananomiya experimental watershed (Aichi), the differences between the inflow and outflow of the gauging pool, the controlling effect of the latter and the effects of breadth of notch are considered. In preparing the hydrographs the lack of coincidence in the curves is attributed to the imperfection of the method, particularly in the separation of the surface run-off and groundwater contributions. The lag between peaks of inflow and outflow varied from 4–35 min. and is negatively correlated with peak-flow height. The peak tends with the years to shift to the right, perhaps an effect of forest growth. Data include the % distribution of the discharge against time for 27 storms (1927–52).

3752. OGIHARA, S. **[A study of a storm hydrograph.]** *Bull. Tokyo Univ. For.* No. 47, 1954 (65–90). 3 refs. [Jap.jap.e.]

Derives a basic formula for a storm hydrograph showing the relation between river discharge and the rainfall from which it is immediately derived, the amount, duration, and changes of intensity, of the latter being obtained from a self-recording gauge.

3753. LOVE, L. D. **The effect on stream flow of the killing of Spruce and Pine by the Engelmann Spruce beetle.** *Trans. Amer. geophys. Union* 36 (1), 1955 (113–8). 6 refs. H.S.B.

An outbreak of this beetle in 1941–46 killed Engelmann Spruce and Lodgepole Pine on a considerable part of the 762 sq. mile drainage basin of White River above the town of Meeker, Colorado. Analyses of stream flow show that this increased after the beetle outbreak, an increase attributed to reduced transpiration and interception of snow. *From author's summary.*

3754. STEBBING, E. P. **The creeping desert in the Sudan and elsewhere in Africa, 15° to 13° latitude.** McCorquodale & Co. (Sudan) Ltd. 1953. pp. 165. 18 refs.

Discusses the forests of the present and past, erosion and drought, the creeping desert, scrub forest and savanna, rainfall and water supplies and remedial measures.

3755. GLOVER, SIR H. M. **Soil conservation in parts of Africa and the Middle East. Part II (cont.). Israel.** *Emp. For. Rev.* 34 (1), 1955 (49–50 + 9 photos).

Cf. *For. Abstr.* 16 (No. 1380).

3756. KHAN, M. I.-U.-R. **Flood control on the Indus river system.** *Pakistan J. For.* 4 (4), 1954 (223–36 + map). 22 refs.

14. SYSTEMATIC ZOOLOGY

145.7. Insecta. Entomology

See also Nos. 4117, 4281 *et seq.*, 4711–5.

3757. BAIRD, R. B., and NICHOLLS, C. F. **A mobile laboratory for field research in entomology and insect pathology.** *Res. Note Sci. Serv. Dep. Agric. Can.* No. *E*-10, 1955. pp. 7.

Description, with photographs and scale plans, of a mobile unit with the necessary facilities for two persons to work and live in areas where the insects occur. Excluding specialized scientific equipment, it was built and equipped for ca. $6500.

3758. HARRIS, W. V. **Termites and forestry.** *Emp. For. Rev.* 34 (2), 1955 (160–6 + 8 photos). 23 refs.

Mainly a review of literature, covering biology and ecology of termites and damage done to growing trees and to timber.

3759. KEMP, P. B. **The termites of north-eastern Tanganyika: their distribution and biology.** *Bull. ent. Res.* 46 (1), 1955 (113–35 + 14 photos). 10 refs.

Allocates 72 species to 8 zones as follows: coastal (including *Brachystegia* and *Brachylaena* forests), 60; three mainly desert shrub zones, 36, 26 and 17 respectively; riverine forest, 8; evergreen rain forest, 10; Juniper forest, 4; cultivation above 4000 ft., 2. A diagram shows the altitudinal distribution of termites and vegetation and the zones are mapped. Biological notes on the species, a discussion of distribution and two field methods of indicating abundance are included.

3760. RABKIN, F. B., and LEJEUNE, R. R. **Some aspects of the biology and dispersal of the Pine tortoise scale, *Toumeyella numismaticum* (Pettit and McDaniel) (Homoptera: Coccidae).** *Repr.* from *Canad. Ent.* 86 (12), 1954 (570–5). 5 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 167.)

Notes on the life-history of the scale. Dispersal of the nymphs after emergence is chiefly by air currents, though some locomotive migration was also observed.

3761. FANG, S. C., and ALLEN, D. **Distribution and incorporation of radioactive phosphorus in the Douglas-Fir beetle.** *J. econ. Ent.* 48 (1), 1955 (79–82). 11 refs.

A study of the distribution of P^{32} in different parts of the body of *Dendroctonus pseudotsugae* and its incorporation into phosphorylated intermediates.

3762. CHAPMAN, J. A. **Ingestion of paper and vegetables by the Douglas-Fir beetle, *Dendroctonus pseudotsugae* (Hopk.).** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 11 (2), 1955 (4).

Experiments showed that the beetles will ingest paper and certain fruits and vegetables, which raises several questions concerning the nature of the sensory cues upon which they depend for normal bark feeding and possibly for initial attack upon trees or logs.

3763. WELLINGTON, W. G., SULLIVAN, C. R., and HENSON, W. R. **The light reactions of larvae of the spotless fall webworm, *Hyphantria textor* Harr. (Lepidoptera: Arctiidae).** *Repr.* from *Canad. Ent.* 86 (12), 1954 (529–42). 7 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 181.)

At room temperature, larvae of all instars are initially photopositive to point sources. In younger larvae, starvation produces a change from a photopositive to a more flexible state, in which, however, the larvae still move with reference to the location of the light source. Older larvae simply compass more consistently than when fed. Whether fed or starved, all instars react more or less photopositively in a dark-light alternative chamber at room temperature, although the reaction is stronger during the first 3 instars. At higher temperatures in the chamber, larvae of the first 3 instars become strongly photonegative, whereas those of the last 3 simply become more strongly photopositive. Starvation lowers the temperature at which these changes take place by 3° C. or more. Out of doors, fed or starved larvae crawling on the ground orientate with respect to the sun. When cool, they travel directly towards it, but turn more and more away from it as they become warmer, finally moving directly away from it when overheated. Again starvation only lowers the temperature range in which this gradual change takes place. Larvae travelling over the ground at any given temperature maintain their orientation by means of their response to plane polarized light and consequently they will respond to rotation of an overhead polarizer through 90° by changing direction a corresponding amount. [Cf. *For. Abstr.* 15 (No. 2683).] *From authors' summary.*

3764. GHENT, A. W. **Light reactions of newly-hatched larvae of the Jack-Pine sawfly, *Neodiprion americanus banksianae* Roh.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 11 (2), 1955 (2).

15. ANIMAL ECOLOGY. GAME AND FISH MANAGEMENT, HUNTING, SHOOTING AND FISHING

See also Nos. 4210, 4271 *et seq.*, 4840.

3765. SZEDERJEI, A. **A korszerü vadászgazdálkodás súlyponti kérdese: a mezei nyúl tenyésztése. [The main task of modern game management [in**

Hungary]: hare breeding.] *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (191–201). [Hu.russ.e.g.]

It is stressed that > 80% of all furred game shot are hares, up to 1 million being killed yearly, the meat and fur being of great economic value. The management plan (detailed) must see that significant damage to forestry is avoided.

3766. HAUER, L. Kísérletek lombtakarmánnyal. **[Game feeding with ensiled leaf fodder.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (202–12). [Hu.russ.e.g.]

In Hungary tree foliage is used chiefly for the emergency feeding of deer in winter—on a small scale, and generally dried. The author shows, from samples of broadleaved species, that its nutritive value may be high but that green fodder, which deer prefer, contains much Ca and P. He tabulates the nutrient contents of fodder ensiled under his instructions and describes successful feeding trials with it.

3767. HAUER, L. A vadkárelhárítás biológiai módszereinek vizsgálata 1952-ben. **[Investigations on the biological control of game damage.]** *Erdész. Tud. Int. Évk.* 2, 1952 (1954), (248–57). [Hu.russ.e.g.]

An interim local study (Pilis and Mátra mountains) of the game population, its movements and feeding habits, with special reference to the browsing of terminal shoots—found to be essentially a sign of green fodder shortage. Measures to relieve this, e.g. by raising frost-hardy greens on game pastures and sparing palatable broadleaved trees at thinnings, are recommended.

3768. JOHNSON, F. W., and ADAMS, L. **Some lessons from Europe in forest big game management.** *J. For.* 53 (6), 1955 (436–8). 9 refs.

In parts of Europe, game policy includes a 30% per annum kill of deer, winter feeding, and fencing of regeneration areas. It is suggested that in American conditions fencing at ca. $10·5/acre might eliminate the need for planting ($35/acre), and still leave money for assisting natural regeneration.

16. GENERAL BOTANY

160. *Plant Chemistry*

See also Nos. 3735, 3775, 3783–5, 4007, 4183–4, 4525 *et seq.*, 4789 *et seq.*

3769. TAMM, C. O. **Studies on forest nutrition. 1. Seasonal variation in the nutrient content of conifer needles. 2. An experiment with application of radioactive phosphate to young Spruces and Birches.** *Medd. Skogsforsknlnst., Stockh.* 45 (5/6), 1955. pp. 34 + 10. 29 refs. [E.e.sw.] Price *Kr.*3.

(1) Samples from Norway Spruce and Scots Pine collected in 1950–54 showed for both species a maximum of N, P, K, expressed as dry weight %, in late autumn and winter, values remaining fairly constant during this period, and a minimum in early summer. This variation in nutrient % is caused to a large extent by variations in dry weight of the needles, which is at a maximum in spring and decreases from the beginning of June to the end of July. It is concluded that photosynthetic products are stored in the needles during spring and translocated downwards during summer. Samples for determining the nutrient status of a tree or stand should be taken when nutrient contents are most constant, during late autumn or winter. (2) In May 1954, a solution of P^{32} was applied in furrows in the soil of a stand of 15-year-old Norway Spruce, containing some Birch. Laboratory tests after 1 month showed considerable radioactivity in needles from Spruce within ½ m., slight activity from those within 1·5 m., and no activity for those 2·5 m., from the furrows. Birch at ½ m. distance showed greater activity than Spruce in the same row. Spruce needles of the current year showed considerably more activity than older ones, but the fairly high figures for active P in the latter showed that P exchange between them and other organs must occur.

3770. PURI, G. S., and GUPTA, A. C. **Seasonal variation in foliar composition of some Indian forest trees.** *J. Indian bot. Soc.* 33 (4), 1954 (382–93). 50 refs. O.B.D.

A study of seasonal variation in foliar ash, Ca, Mg and N in *Pinus longifolia*, *Adina cordifolia*, *Shorea robusta*, *Eugenia jambolana*, *Terminalia arjuna*, *T. tomentosa*, *Tectona grandis*, *Ougeinia dalbergioides*, *Cedrela toona* and *Dalbergia sissoo*.

3771. HILLIS, W. E. **Formation of leuco-anthocyanins in Eucalypt tissues.** *Nature, Lond.* 175 (4457), 1955 (597–8). 4 refs. [Division of Forest Products, C.S.I.R.O., Melbourne.]

Recent work has shown that the leuco-anthocyanidins may be one of the first forms of polyphenolic compounds synthesized in a plant, and the precursor of the various classes of anthoxanthidins and the anthocyanidins. If this were so, appreciable amounts of leuco-anthocyanins might be expected to be formed in areas of intense metabolism. This hypothesis has now been tested by examination of the first-formed young leaves, red in colour, from several species of Eucalyptus (*E. sieberiana*, *E. elaeophora*, *E. regnans* and *E. obliqua*). It was found that the body of the leaves contained anthocyanins and also appreciable quantities of leuco-anthocyanins, but the greatest amount of the latter was found in the leaf tip, which is probably the area of most intense cell division. The hypothesis also held in another area of intense cell division and expansion —the cambial region. In a log of *E. regnans*, considerable amounts (1·3%) of leuco-anthocyanidin were found in the cambial region, the phloem contained 1·8% and the sapwood 0·04%. After the spring flush of growth had passed, leuco-anthocyanins were difficult to detect in the cambium. Investigation of several cross-sections of *E. marginata* from the cambium inwards showed an increase in leuco-anthocyanin at the boundary between sapwood and heartwood, the value remained fairly constant across the outer heartwood zone, and there was then a steady decrease. It seems likely, therefore, that the leuco-anthocyanins are not synthesized at the sapwood-heartwood boundary, but are translocated to this locality, where the final changes to heartwood extractives would take place.

3772. ROBINSON, R., and SMITH, H. **Anthocyanins of the leaf of the Copper Beech (*Fagus sylvatica*) and the fruit of the cultivated strawberry**

(*Fragaria virginiana*). *Nature, Lond.* 175 (4458), 1955 (634). 7 refs. [Dyson Perrins Laboratory, University of Oxford.]

Chromatographic examination showed that the anthocyanin responsible for the pigmentation of Copper Beech leaves is idaein.

3773. Loev, B. **The active constituents of Poison Ivy and related plants [Anacardiaceae]: structure and synthesis.** *Abstr. of thesis*, in *Dissert. Abstr.* 15 (3), 1955 (327–8). [Columbia University.] O.R.S.

161. *Physiology*

See also Nos. 3769, 3771, 3864 *et seq.*, 4007, 4105, 4108, 4127, 4166, 4174, 4177, 4206, 4236, 4704–6.

3774. Biddulph, O. **Studies of mineral nutrition by use of tracers.** *Bot. Rev.* 21 (5), 1955 (251–95). 9½ pp. of refs. [State College of Washington, Pullman.]

A review of literature under the heads: procedures (direct counting, autoradiography); absorption; translocation; metabolism (Ca, Cu, I, Fe, Mn, Mo, P, S, Na, Zn); and radiation injury (to plants).

3775. **Annual review of plant physiology.** Annual Reviews Inc., Stanford, Calif. No. 6, 1955. pp. 505. Many refs. Price $7·50 (£3).

Includes the following review articles, containing many references to forest species: Mechanisms of absorption, transport, accumulation and secretion of ions (*H. Lundegårdh*); Redistribution of mineral elements during development (*R. F. Williams*); Nitrogen metabolism (*G. C. Webster*); Functional aspects in mineral nutrition of green plants (*A. Pirson*); Biochemical factors of photosynthesis (*W. Vishniac*); Effect of ecological factors on photosynthesis (*M. D. Thomas*); Chemical constitution as related to growth regulator action (*R. M. Muir* and *C. Hansch*); The physiology of flowering (*J. L. Liverman*); Physiology of abscission (*F. T. Addicott* and *R. S. Lynch*); The water economy and the hydrature of plants (*H. Walter*); Water relations of plant cells and tissues (*P. J. Kramer*); Colour development in flowers (*K. Paech*); Pathogenesis in the wilt diseases (*A. E. Dimond*); Chemical nature of disease resistance in plants (*J. C. Walker* and *M. A. Stahmann*); Adaptation of plant pathogen to host (*J. J. Christensen* and *J. E. DeVay*); Tissue culture (*R. J. Gautheret*).

3776. Lundegårdh, H. **The transport of water in wood.** *Ark. Bot.* 3 (6), 1954 (89–119). 17 refs. [E.] O.B.D.

A summary is given of the main results of the author's investigations into: (1) sap pressure and sap exudation in *Betula alba* s.l., and suction pressures and air content in Birch, Lime and Oak; (2) concentration of solutes in the bleeding sap and in the transpiration stream of Birch; (3) dimensions of vessels and tracheids on transverse sections of Lime, Birch and Oak; (4) displacement of water in longitudinal stem sections of the same 3 species, when subjected to centrifuging; and (5) slow- and fast-moving water in the stem, and the capacity of the transpiration stream. The main results of the investigations can be summarized in two statements: (*a*) the living wood always contains a high proportion of air, primarily in the large vessels, and (*b*) the fast-moving water serving as a conductor of the transpiration stream, only amounts to a small % of the total amount of water in the wood; it follows a continuous course from the roots to the leaves and is located primarily in the medium-sized tracheids, i.e. those with an average diam. of ca. 10 μ.

3777. Greenidge, K. N. H. **Studies in the physiology of forest trees. II. Experimental studies of fracture of stretched water columns in transpiring trees.** *Repr.* from *Amer. J. Bot.* 42 (1), 1955 (28–37). 7 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 145.)

[Cf. *For. Abstr.* 15 (No. 1624); 16 (No. 2657).] The influence of root pruning was observed in adult trees, mainly *Betula lutea*, and *Acer saccharum*, but also in *Ulmus americana*, *Acer rubrum*, *Fagus grandifolia*, *Populus balsamifera* and *Abies balsamea*. Paths of moisture movement were followed by injecting an aqueous solution of acid fuchsin into the lower boles of treated and untreated trees. Clearly defined departures from normality were exhibited by pruned trees. There were equally evident differences in the distribution of moisture in the boles and crowns of treated and untreated trees. The nature of the differences was indicative of widespread fracture of stretched water columns, leading to the presence of excessive amounts of gas in the conducting elements, with a concomitant loss of function in these cells and a reduction in the amount of moisture in the affected tissues. This study confirms previous conclusions that fracture of stretched water columns occurs at tensions of ca. 30 atm.

3778. Rodionov, M. S. K metodike opredelenija intensivnosti transpiracii drevesnyh porod. **[On [Ivanov's rapid weighing] method for determining the transpiration rate of woody species.]** *Bot. Ž.* 40 (1), 1955 (97–8). [Russ.] [Vsesojuznyĭ Naučno-issledovateljskiĭ Institut Agro-lesomelioracii.]

The only troublesome operation in Ivanov's rapid weighing method for determining transpiration [see *For. Abstr.* 12 (No. 1748)] is that of cutting the twigs while immersed in melted paraffin wax. In summer 1954, the present author compared data for twigs cut (*a*) without, and (*b*) with immersion in paraffin wax, from one tree of *Ulmus parvifolia* in an irrigated shelterbelt and one of 'Canadian' Poplar in an unirrigated shelterbelt in Astrakhan province. The pairs of twigs to be cut, as uniform as possible, were selected in various parts of the crowns and marked before the experiment. The number of determinations was (*a*) 93 and (*b*) 92 for the Elm, and 60 each of (*a*) and (*b*) for the Poplar. The exposure (time between first and second weighing) was in all cases 3 min., and transpiration values were calculated in mg. water/g. fresh leaf weight/hour. Fresh leaf weight was found by stripping the leaves immediately after the second weighing, finding the weight of the twig, and deducting this from the total weight at the first weighing. The determinations were made on 18 Aug. in the period of maximum transpiration, i.e. between 9 a.m. and 3 p.m.

For Poplar twigs (6–12 g.) the balance used was accurate to 10 mg.; for Elm (300–500 mg.), to 1 mg. The data are statistically analysed to show that use of paraffin wax has no significant effect on results and might therefore be discarded. The means found were: Elm—(*a*) 724 ± 15, (*b*) 690 ± 16; Poplar—(*a*) 249 ± 6·1, (*b*) 257 ± 6·9 mg./g./hour.

3779. Härtel, O., and Papesch, E. Über die Wachsausscheidungen von Koniferen. [**The wax secretions of conifers.**] *Ber. dtsch. bot. Ges.* 68 (3), 1955 (133–42). 9 refs. [G.g.] O.B.D.

Measure of the turbidity of aqueous needle extracts was used in the quantitative analysis of the wax secretions found on the surface of Spruce needles. Amounts of wax vary with age of needle, height of branch, exposure and/or position of the tree on a slope, and also show a seasonal rhythm. Amounts rise in spring and autumn, and are at a minimum in summer; atmospheric influences (e.g. exposure to winds) can reduce them. Long exposure of needles to small concentrations of SO_2 caused turbidity of the extracts to rise to very high values. Such tests might be used to detect injury from industrial fumes.

3780. Nakano, M., and Kojima, H. [**Fundamental experiments on natural regeneration. (VI). Effects of sunlight intensity on the starch metabolism.**] *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (18–22). [Jap.jap.e.]

[Cf. *For. Abstr.* 16 (No. 2661).] Full lighting reached maximum intensities of 34,000–35,000 luxes in the period 11.30 a.m. to 1.30 p.m. For the highest starch production the most suitable light intensity for *Picea glehnii* is 9000–11,000 luxes and for *Picea jezoensis* 11,000–12,000. Starch metabolism curves (different in the two species) show for both, in full light, peaks at 10 a.m. and 2 p.m. Graphs have English legends.

3781. Suto, S. [**Studies on N nutrition of *Cryptomeria* seedlings (1). Relations between growth and accumulation of carbohydrates for different nutrient treatments.**] *J. Jap. For. Soc.* 35 (7), 1953 (215–20). 6 refs. [Jap.jap.e.]

Results of measurements on *C. japonica* seedlings are given in graphs and tables with English legends showing rate of height and diameter growth and % reducing and non-reducing sugars, crude starch, total carbohydrate, weight of dry matter and total N at different periods of the year and for treatments with N, P, K or NPK.

3782. Suto, S. [**Studies on N nutrition of *Cryptomeria* seedlings (3). The N dressing and the growing phase.**] *J. Jap. For. Soc.* 36 (7), 1954 (183–7). 11 refs. [Jap.e.]

(1) In seedlings treated with N on 20 and 25 August, when soil and air temperature were about 24° C., growth of roots and lateral shoots was increased more than that of leaders. The amount of reducing sugars contained in the seedlings, was lowered and their moisture content was not increased. (2) The growth of the leader is expressed as (*a*) length of longest lateral shoot/length of leader; (*b*) number of branches on leader/increased length of leader. [Results are given in tables with English legends.] *From author's summary.*

3783. Reuter, G., and Wolfgang, H. Vergleichende Untersuchungen über den Charakter der Stickstoff-Verbindungen von Baumblutungssäften bei Betulaceen und anderen Holzarten. [**Comparative investigations into the nature of nitrogen compounds in the bleeding sap of Betulaceae and other tree species.**] *Flora, Jena* 142 (1), 1954 (146–55). 11 refs. [G.g.] O.B.D.

Among the Betulaceae, citrullin in the bleeding sap predominates in the same way as allantoin or allantoic acid in sap of the Aceraceae, and plays a rôle in the primary processes of N assimilation. The other species investigated belong to the acid amide type. *Aesculus* holds a position between the two types. *From author's summary.*

3784. Yokota, S. **Nitrogen absorption and amino acid formation by *Fusarium solani* (Mart.) APP et WR.** *Bull. Tokyo Univ. For.* No. 47, 1954 (155–61). 15 refs. [E.e.jap.]

N was offered as (1) NH_4Cl, (2) NH_4NO_3, (3) KNO_3, (4) asparagine, and (5) glycine, in culture solutions, and absorption determined by analysis, the amino-acids being detected by two-dimensional paper-partition chromatogram.

3785. Yokota, S. **On some phenomena in the development of *Fusarium lateritium* (Nees) Snyder et Hansen, when asparagine and ammonium nitrate are supplied as nitrogen source.** *Bull. Tokyo Univ. For.* No. 47, 1954 (163–72). 5 refs. [E.e.jap.]

A similar investigation to that outlined in the preceding abstract, yielded similar results. This species, however, shows less asparaginase activity than *F. solani.*

3786. Bhattacharjya, S. S., and Linskens, H. F. **Recent advances in the physiology of self-sterility in plants.** *Sci. & Cult.* 20 (8), 1955 (370–3). 27 refs. E.M.B.

Quotes 27 references (1914–55) and sums up in favour of an immunity reaction narrowly coinciding with the nutrition-physiology of pollen-tube growth. The high specificity of the reaction, which in the homostylic species is guided by only one allelic pair, suggests a typical protein reaction. The irreversible inhibition occurs only in the tubes; stigmas pollinated with incompatible pollen showed that the growth of the latter was unaffected.

3787. Currier, H. B., Esau, K., and Cheadle, V. I. **Plasmolytic studies of phloem.** *Amer. J. Bot.* 42 (1), 1955 (68–81). 26 refs. O.B.D.

Presents the results of studies of 23 species including several tree species.

163. *Embryology*

3788. Prozina, M. N. Èmbriologičeskoe issledovanie klena ostrolistnogo (*Acer platanoides* L.) v. svjazi s plohim plodonošeniem v uslovijah Kamyšina. [**Embryological investigation on *A. platanoides* in connexion with poor seedbearing in the Kamyšin area.**] *Bjulletenj moskovskogo Obščestva Ispytateleĭ Prirody* (*Otdel biologičeskiĭ*),

Moskva 58 (2), 1953 (66–75). [Russ.] From *abstr.* in *Referat. Ž.* (*Biol.*) 1954 (1), (No. 602) [Russ.] H.S.B.

Many *A. platanoides* inflorescences contain all transition stages from typical ♂ to typical ♀ flowers; the pollen from the latter seems to be infertile. In ca. ¼ of the seeds the embryos die and the fruits drop, mainly owing to drought. The partial dropping observed in trees growing in favourable conditions is chiefly of ♂ and intermediate flowers which do not set fruit.

3789. Baranov, P. A., Baranova, E. A., and Polunina, N. N. Interesnaja osobennostj èmbriogeneza èvkalipta. [**An interesting feature in the embryogeny of Eucalypts.**] *Bot. Ž.* 40 (1), 1955 (99–102). 4 refs. [Russ.] [Botaničeskiĭ Institut im. V. L. Komarova Akademii Nauk SSSR, Leningrad.]

Describes and illustrates a coleorhiza-like sheath, in some cases completely covering the growing point of the radicle, developed from the base of the hypocotyl in many species of *Eucalyptus* (listed). On germination, the sheath expands laterally, at right angles to the radicle, into a disc which develops ordinary root hairs before any are formed on the radicle itself. Like the epidermis of the hypocotyl, that of the disc contains oil glands, which are not found in the roots.

3790. Dnyansagar, V. R. **Embryological studies in the Leguminosae VII, IX–X.** *J. Indian bot. Soc.* 33 (3; 4), 1954 (247–53; 423–42). 10 + 31 + 30 refs. O.B.D.

(VII) *Neptunia triquetra* and *Prosopis spicigera.* (IX) *Dichrostachys cinerea* and *Parkia biglandulosa.* (X) Supplementary observations on *Leucaena glauca* and *Mimosa hamata.*

164. *Morphology*

See also Nos. 3830, 3892.

3791. Wilcox, H. **Primary organization of active and dormant roots of Noble Fir, *Abies procera*.** *Amer. J. Bot.* 41 (10), 1954 (812–21). 30 refs. O.B.D.

Studies of the structure of the primary root of Noble Fir during active growth and of the changes following cessation of growth leading to dormancy. *From author's summary.*

3792. Pitot, A. Sur l'évolution en structure radiculaire de la structure du rhizophore de *Rhizophora racemosa.* [**The development of root structure in the rhizophore of *R. racemosa.***] *C.R. Conf. int. Afr. Ouest, Abidjan 1953*, [1954] (33). [F.]

Summary of paper stating that the string-like rhizophores which grow downwards from the stem and branches of trees growing in fresh or brackish water, change from stem to root structure at the point where they enter the water, the metaxylem cylinder reversing its growth at this point from centrifugal to centripetal, a fact that should have repercussions on the classical theory of the evolution of the shoot from the root in angiosperms.

3793. Seeliger, I. Studien am Sprossvegetationskegel von *Thujopsis dolabrata* (L.f.) Sieb. et Zucc. [**The shoot apex of *T. dolabrata.***] *Flora, Jena* 142 (1), 1954 (183–212). Many refs. [G.g.] O.B.D.

3794. Garrison, R. **Studies in the development of axillary buds.** *Amer. J. Bot.* 42 (3), 1955 (257–66). 17 refs. O.B.D.

Consideration is given to the origin and development of axillary buds of *Magnolia stellata* var. *rosea, Liriodendron tulipifera, Alnus japonica, Akebia quinata* and *Schizandra chinensis* and of the axillary and accessory buds of *Juglans cinerea* and *Pterocarya rehderiana. From author's summary.*

3795. Florin, R., and Boutelje, J. B. **External morphology and epidermal structure of leaves in the genus *Libocedrus s. lat.*** *Acta Horti Bergiani, Uppsala.* 17 (2), 1954 (8–37 + 10 plates). 28 refs. [E.e.] P.R.

[Cf. *For. Abstr.* 16 (No. 100).] Includes a key to the genera *Heyderia, Libocedrus, Papuacedrus, Austrocedrus* and *Pilgerodendron* and their species, based on the external morphology and epidermal structure of leaves on sterile branches. These are described in detail and illustrated for each genus.

3796. Podgórska, J. Materiały do studium nad geograficzną zmiennością liści buka (*Fagus silvatica* L.) w Polsce. I. Analiza populacji buka na północnym Roztocza pod względem cechy 'ilości nerwów bocznych'. [**Geographical variation in leaves of *F. sylvatica* in Poland. I. Statistical analysis of the Beech population of North Roztocze in respect of number of lateral veins in leaves.**] *Acta. Soc. Bot. Polon.* 24 (1), 1955 (95–108). 6 refs. [Pol.g.] O.B.D.

The number of lateral veins in leaves shows so much variation that it cannot serve as a taxonomic criterion. The variation seems to be geographical, the average values increasing slightly but definitely from West to East. *From author's summary.*

3797. Sacher, J. A. **Cataphyll ontogeny in *Pinus lambertiana*.** *Amer. J. Bot.* 42 (1), 1955 (82–91). 34 refs. O.B.D.

3798. Nagaraj, M. **Floral morphology of *Terminalia belerica* Roxb.** *Curr. Sci.* 24 (35) 1955 (89–90). A.P.B.

3799. Zobel, B. J. **Abnormal cone formation in Pines.** *Texas Journal of Science, San Marcos* 4 (4), 1952 (517–20). 7 refs. L.S.

Describes a 13-year-old Ponderosa Pine growing near Berkeley, Calif., in which 14 ovulate cones were produced in the lower ⅛ of the leader, and none in their normal position near the terminal bud, and discusses the potential value of such abnormalities in breeding.

3800. Bannister, M. H. **Variation in a sample of *Pinus radiata* cones from the Nelson District.** *Transactions of the Royal Society of New Zealand, Wellington* 82 (1), 1954 (25–40). 16 refs. L.S.

Cones from 250 trees varied in size, proportions and shape, and in characters of the apophyses, umbos and mucros. Variation was great between the cone populations of different trees. Each character seemed to vary continuously between two

distinct extremes. When the variation was compared with earlier descriptions of the species it seemed to correspond closely with that in its natural habitat. *From author's summary.*

3801. SCHROEDER, C. A. **Fruit morphology and anatomy in the White Sapote [*Casimiroa edulis*].** *Bot. Gaz.* 115 (3), 1954 (248–54). 6 refs. O.B.D.

3802. HARDIN, J. W. **Studies in the Hippocastanaceae. I. Variation within the mature fruit of *Aesculus*.** *Rhodora* 57 (674), 1955 (37–42 + 1 plate). 7 refs. O.B.D.

165. *Phylogeny, Evolution. Heredity, Genetics and Breeding; Variation*

See also Nos. 3786, 3799–3800, 3865, 3894, 3964, 3969–73, 3987–9, 4110–1, 4352.

3803. GRIFFITH, A. L. **The possibilities of tree-breeding and of tree seed orchards in East Africa.** *E. Afr. agric. J.* 20 (4), 1955 (241–4). 2 refs.

A review of the work done in Scandinavia (particularly in Sweden) and its applicability to East African requirements, and of the beginnings of the work there with Cypress and Pine.

3804. CRAM, W. H. and BRACK, C. G. E. **Tree breeding [in connexion with the Prairie Tree Planting Programme.]** *Progr. Rep. Dom. For. Nursery Sta. Sask. 1947–52*, 1954 (31–5).

Gives some results to date of breeding work on *Caragana arborescens* [cf. *For. Abstr.* 14 (No. 97)], *Pinus sylvestris* [cf. *For. Abstr.* 15 (No. 2423)] and *Picea* spp. [cf. *For. Abstr.* 13 (No. 2926)].

3805. TULECKE, W. R. **Preservation and germination of the pollen of *Ginkgo* under sterile conditions.** *Bull. Torrey bot. Cl.* 81 (6), 1954 (509–12). 9 refs. O.B.D.

Outlines a method by which pollen of *G. biloba* has been successfully preserved for > 2 years.

3806. MERGEN, F., HOEKSTRA, P. E., and ECHOLS, R. M. **Genetic control of oleoresin yield and viscosity in Slash Pine.** *For. Sci.* 1 (1), 1955 (19–30). 17 refs.

The progeny of outstanding phenotypes had higher than average yields; viscosity is under rigid genetic control; in trees up to 30 years the number of radial resin ducts per annual ring, and their size, decreased rapidly with increasing age, the former until the 15th year, the latter over the whole period, and the lack of high correlation between parent and progeny in this respect may have been due to the young age of the sample; progeny from open pollinations was much more variable than that from controlled crosses. [Cf. *For. Abstr.* 16 (No. 3033).]

3807. **Controlled pollination studies [with Pines].** *Rep. Ntheast. For. Exp. Sta. 1954*, 1955 (35–7).

Eleven different species combinations were obtained in 1947–54 among the White Pines; of these, *P. griffithii* × *P. strobus*, *P. strobus* × *P. griffithii* and *P. strobus* × *P. ayacahuite* are of interest because of their rapid growth. With hard Pines in the series *Lariciones*, 15 of 37 species combinations attempted proved successful; results are tabulated. Of 14 reciprocal crosses 11 gave the same results in both directions. No successful crosses have so far been obtained with *P. resinosa* but most of the Japanese and Chinese species have crossed with each other. Fifteen-year tests indicate hybrid vigour in *P. thunbergii* × *P. densiflora* and *P. densiflora* × *P. sylvestris*. *P. thunbergii* × *P. yunnanensis*, *P. thunbergii* × *P. massoniana* and *P. densiflora* × *P. nigra* could be mass-produced fairly easily.

3808. **Three-way hybrid shows dynamics of tree breeding.** *Rep. Calif. For. Range Exp. Sta. 1954*, [1955] (17–9).

Two-year-old seedlings from a cross between the *Pinus ponderosa* × *P. engelmannii* hybrid, already developed and found promising, and *P. montezumae*, exceeded *P. ponderosa* and various hybrids in height (14·9 in.) and equalled *P. ponderosa* × *P. engelmannii* in diameter (0·54 in.). [Cf. *For. Abstr.* 14 (No. 3052).]

3809. HOLST, M. J. **Breeding for weevil resistance in Norway Spruce.** *Z. Forstgenet.* 4 (2), 1955 (33–7). 24 refs. [E.e.g.f.]

Observations in a Norway Spruce plantation at the Petawawa Forest Experiment Station showed that slender genotypes with narrow brush-type crowns are associated with light weevil damage, whereas stout genotypes with broad comb-type crowns tend to be severely damaged. The significance of this for breeding weevil-resistant strains is discussed. A more promising line appears to be the hybridization of the weevil-resistant White Spruce with Norway Spruce. Attempts at direct crosses have so far failed; the possibilities are now being explored of using Sitka Spruce to establish a bridge for the transfer of genes for weevil-resistance from White to Norway Spruce. *From author's summary.*

3810. NAKAHIRA, K. **[Studies on the breeding of trees of special uses. III. Intervarietal F_1 hybrids of Mitsumata (*Edgeworthia papyrifera*).]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 76, 1954 (73–80). 9 refs. [Jap.jap.e.]

Describes and illustrates [with English captions to tables and figures] the morphological and cytological characteristics of the F_1 generation from Kochi × Shizuoka strains.

3811. PILIPENKO, F. S. Novye dannye o vido- i formoobrazovanii u èvkalipta. **[Fresh data on the formation of species and forms in *Eucalyptus*.]** *Agrobiologija* 1954 (5), (69–88). 5 refs. [Russ.] I.M.I.

In extension of previous work [see *For. Abstr.* 14 (No. 98)] the author lists, with discussion of some, the following cases of forms of one *Eucalyptus* species [unbracketed] occurring among progeny of another [bracketed]: *E. vitrea* (*E. laevopinea*), *E. angophoroides* (*E. deanei*, *E. cinerea* forms, *E. ovata* var. *grandiflora*, and *E. dalrympleana*), *E. stuartiana* (*E. cephalocarpa*), *E. viminalis* (*E. cinerea* forms, *E. cordata* and *E. novo-anglica*), *E. rubida* (*E. angophoroides*), *E. cinerea* (*E. angophoroides*), and *E. rubida*), *E. cephalocarpa* (*E. cinerea*). He now rejects the possibility of hybridization, whether in Russia or Australia, as one of the possible causes

of such variation, presenting some evidence on flowering periods, range, possibilities of natural cross-pollination and results of artificial crossings, in support of this claim for some of the cases listed. The variants that have arisen in Russia (some illustrated in drawings or photos) have been identified from material in the flowering and fruiting stages. It is once more urged that they must have arisen through the effects of the new environment, the variations being interpreted as adaptive in nature.

3812. CALDWELL, D. H. **Natural variation observed in Shagbark Hickory, *Carya ovata* (Mill.) K. Koch, in central New York.** *Rep. Nth. Nut Growers' Ass.* No. 44, 1953 (29–39). E.M.B.

The results of observations made over a period of 3 growing seasons on bark, buds, twigs, leaves, flowers and fruit.

3813. PJATNICKIĬ, S. S. Massovoe vosproizvodstvo gibridnyh želudeĭ. **[Mass production of hybrid acorns.]** *Lesn. Hoz.* 5 (8), 1952 (42–4). [Russ.]

Gives a very brief account of the author's work, with special reference to artificial pollination, pollen storage and testing [see *For. Abstr.* 10 (No. 1605); 13 (No. 103); 16 (No. 2678)]. With improvements in technique, the production of acorns of the 3 most promising crosses was 1825 of *Quercus macranthera* × *Q. macrocarpa* (57·3% of the number of ♀ flowers pollinated) and 997 of *Q. macranthera* × *Q. borealis* (34·4%) in 1949; and 2772 of *Q. macranthera* × *Q. robur* (14·4%) in 1951.

3814. CHISMAN, H. H. **The natural hybrid Oaks of Pennsylvania.** *Res. Pap. Pa. St. For. Sch.* No. 22, 1955. pp. 3. 8 refs.

Lists all the known natural hybrids.

3815. KOLTAY, G. Szabadbeporzású nyármagcsemete populációk vizsgálata. **[Investigations on seedling populations obtained by free pollination of Poplars.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (31–41). [Hu.russ.e.g.]

A detailed report by the Hungarian Institute of Forest Sciences for all Poplars in Hungary save *P. tremula*, proper material for which was lacking. The characteristics, affinities and utility of the various progenies are discussed. Those of *P. alba* (which is rather homogeneous) and *P. canescens* can be utilized with little or no selection; but not those of *P. nigra*, *P. nigra* var. *thevestina*, ×*P. marilandica* or *P. angulata*.

168. *Histology*

See Nos. 3775, 3787, 4108, 4236, 4472 *et seq.*

17. SYSTEMATIC BOTANY

3816. GUINIER, P. Les forestiers et la nomenclature botanique. **[Foresters and botanical nomenclature.]** *Rev. for. franç.* 7 (7), 1955 (517–21). 4 refs. [F.]

Discusses recent changes adopted in the U.S. Forest Service Checklist, and the reaction of American foresters to them, with additional evidence from some European species of the inconvenience of such changes. [Cf. *For. Abstr.* 16 (No. 2708).]

3817. WHITEHEAD, F. H. **An example of taxonomic discrimination by biometric methods.** *Repr.* from *New Phytol.* 53 (3), 1954 (496–510). 4 refs. [Department of Botany, University of Oxford.]

The methods described involve the use of discriminant analysis and are illustrated by an example using 3 annual species of *Cerastium* and six morphological characters.

172.8. Eumycetes (True Fungi)

See also Nos. 4216 *et seq.*, 4694 *et seq.*

3818. SASAKI, T. **Contributions to the Japanese fungus flora III.** *Bull. Tokyo Univ. For.* No. 47, 1954 (145–53). 2 refs. [E.jap.]

Gives synonymy, description, Japanese names and host trees, distribution and type of rot, of *Cytidia salicina*, *Stereum sanguinolentum*, *S. vibrans*, *S. pendulum* Sasaki sp. nov, *Fomitopsis* (*Trametes*?) *sensitiva* and *Bondarzewia montana*.

3819. **Culture-collection of fungi. I. Hymenomycetes.** Departamento de Micologia, Instituto Botânico, Faculdade de Ciências, Lisboa. 1954. pp. 39. 38 refs. [E.] P.R.

A list of species held by the Department of Mycology, giving hosts, locality, country, year of isolation and the names of persons having made the isolation and identification.

3820. PINTO-LOPES, J. Polyporaceae de Portugal (excepto resupinadas)—revisão das colecções portuguesas. **[Polyporaceae of Portugal (excluding resupinate polypores)—a review of the Portuguese collections.]** *Repr.* from *Revista da Faculdade de Ciências de Lisboa* (*Ser. 2*) 3*C* (1), 1953 (157–238). 31 refs. [Port.] P.R.

174. *Spermatophyta, Seed-Plants in General. Floras and Check-Lists*

3821. HAYASHI, Y. **[Notes on Japanese trees and shrubs [Nos. 11–21].]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 77, 1955 (25–34). [Jap.]

Descriptive notes (Latin and some English), illustrated by photographs of herbarium sheets of 11 varieties, forms, or hybrids in the genera *Abies*, *Picea*, *Carpinus*, *Cyclobalanopsis*, *Distylium*, *Photinia*, *Sorbus*, *Prunus*, *Acer*, *Clethra* and *Styrax*.

3822. SABETI, H. **[Determinology [identification] of Iranian forest trees.]** *Publication, Teheran University, Teheran.* No. 20, 1947. pp. 274 + 46 photos. 23 refs. [Per.]

The main body of the book, following a short general description of the forests, consists of an annotated list, by family and species, of the indigenous trees and shrubs, illustrated by 46 plates; this is supported by 4 alphabetical glossaries, viz. scientific name followed by Persian, French, English and German equivalents, with notes on Arabic and local usage; Persian/scientific; English/Persian; French/Persian; German/Persian.

3823. **A.E.T.F.A.T.-index. 1954. Index of the papers on systematic phanerogamy and of the new**

taxa concerning Africa south of the Sahara and Madagascar. Association pour l'Étude taxonomique de la Flore de l'Afrique tropicale, Bruxelles. 1955. pp. 67. [F.E.]

Cf. *For. Abstr.* 16 (No. 1452).

3824. Flore du Congo belge et du Ruanda-Urundi. Spermatophytes. Vol. VI. Papilionaceae (troisième partie). **[Flora of the Belgian Congo and of Ruanda-Urundi. Spermatophytes. Vol. VI. Papilionaceae (part 3).]** Institut national pour l'Étude agronomique du Congo Belge, Brussels. 1954. pp. iv + 426 + 1 map. [F.]

3825. PARDY, A. A. **Notes on indigenous trees and shrubs of Southern Rhodesia**. *Reprs.* from *Rhod. agric. J.* 52 (1), 1955. Each pp. [1] + 1 to 3 plates. (*Bull. Minist. Agric. Lds., S. Rhod.* Nos. 1805–8; 1812–1815).

Bauhinia punctata, *Crossopteryx febrifuga*, *Faurea saligna*, *Turraea nilotica*, *Adina microcephala*, *Croton sylvaticus*, *Dialiopsis africana*, and *Halleria lucida*.

174.2/.7. Gymnosperms

See also Nos. 3795, 4474, 4491.

3826. WARD, J. D. U. **The Maidenhair Tree**. *Quart. J. For.* 49 (2), 1955 (129–31 + 2 photos).

Notes on *Ginkgo biloba*, the date of its introduction into Great Britain, and some large or otherwise notable individuals.

3827. LONGMAN, K. A. **The use of perforated card keys, with special reference to the identification of conifer seedlings**. *Coedwigwr* 2 (3), 1955 (87–93). 10 refs.

The perforated-card key system is outlined and its various advantages described. Disadvantages are discussed, together with methods by which they may be minimized, and a desciption is given of various ways in which card keys have been used. Finally mention is made of a preliminary card key to conifer seedlings, which has been prepared in the Forestry Department, University College of N. Wales, Bangor.

3828. BOIVIN, B. ***Pseudotsuga menziesii* (Mirbel) Franco versus *Pseudotsuga taxifolia* (Poiret) Britton**. *Bol. Soc. broteriana* (*Ser. 2*) 28, 1954 (63–4). [Latin]

A vindication of *P. taxifolia* as the valid name.

175.2. Monocotyledons

3829. TIWARI, S. D. N. **The grasses of Madhya Pradesh**. *Indian For.* 80 (10; 11), 1954 (601–11; 681–9); 81 (2; 3), 1955 (101–15; 191–200). 5 refs.

A systematic account.

3830. SAAKOV, S. G. Paljmy i ih kuljtura v SSSR. **[Palms and their cultivation in the U.S.S.R.]** Izdateljstvo Akademii Nauk SSSR, Moscow and Leningrad. 1954. pp. 319 + 6 folding tbls. 7 pp. of refs. [Russ.]

In three parts: (1) General description of the Palmae and their distribution (pp. 8–44). (2) Types of germination, seedling morphology, leaf variation with age, and the significance of these in phylogeny and classification, with Latin diagnoses of two new subfamilies and several tribes (pp. 45–193). (3) Cultivation in the U.S.S.R.: history; list of species; species cultivated in the open (keys to genera and species; with descriptions, notes on propagation; cultivation of the Date Palm for fruit); room and greenhouse species; and pests (pp. 194–312).

3831. FURTADO, C. X. **Palmae Malesicae: X–XVI**. *Gdns. Bull.* 12 (2), 1949 (378–403); 13 (2), 1951 (300–68).

Covers the genera *Salacca*, *Korthalsia*, *Plectocomiopsis*, *Myrialepis*, *Plectocomia*, *Ceratolobus* and *Calospatha*.

3832. FURTADO, C. X. **The genus *Daemonorops* in Malaya**. *Gdns. Bull.* 14 (1), 1953 (49–147).

176.1. Dicotyledons

See also Nos. 3796, 3811, 3814, 3963–4, 4475–9, 4491–4.

3833. **Report of the standing executive committee on the application to the genus *Populus* of the rules laid down in the international code of nomenclature for cultivated plants**. [*Pap.*] *8th Sess. int. Poplar Comm., Madrid 1955*, No. *FAO/CIP/*76, 1955. pp. 13.

3834. ØSTERGAARD, J. Skjærm-Ælm, *Ulmus laevis* Pall.: et bidrag til vor viden om artens forekomst og trivsel i danske haver, parker og skove. **[*U. laevis*: its occurrence and condition in Danish gardens, parks and forests.]** *Dansk dendrol. Årsskr.* 1, 1950 (9–38). 34 refs. [Dan.]

3835. PICHON, M. Classification des Apocynacées. XXXVII. Une espèce nouvelle du genre *Hunteria*. **[Classification of the Apocynaceae. XXXVII. A new species of the genus *Hunteria* [*H. densiflora*].]** *Bull. Jard. bot. Brux.* 23 (3/4) 1953 (391–3). 1 ref. [F.] O.B.D.

3836. TISSERANT, C., and SILLANS, R. Matériaux pour la flore de l'Oubangui-Chari (Flacourtiacées). **[Materials for a flora of Ubangi Shari—Flacourtiaceae.]** *Phanérogamie* 15 (1), 1954 (93–103). [F.] O.B.D.

Notes on and descriptions of the species of the 10 genera, with keys.

3837. CAVACO, A. Le genre *Lasiodiscus* (Rhamnacées) en Angola; une variété nouvelle du *Lasiodiscus usambarensis* Engl. **[The genus *Lasiodiscus* in Angola; a new variety [var. *gossweileri*] of *L. usambarensis* Engl.]** *Bol. Soc. broteriana* (*Ser. 2*) 28, 1954 (177–9 + 1 plate). [F.]

3838. ARÈNES, J. Un *Acridocarpus* nouveau de Madagascar. **[A new *Acridocarpus* from Madagascar.]** *Phanérogamie* 15 (1), 1954 (4–5). [F.] O.B.D.

A. humbertii, a tree 15–20 m. high.

3839. CAVACO, A. Sur le genre *Phanerodiscus* gen. nov. (Olacacées) de Madagascar. **[A new genus *Phanerodiscus* (Olacaceae) from Madagascar.]** *Phanérogamie* 15 (1), 1954 (10–4). 9 refs. [F.] O.B.D.

The new genus and species, *P. perrieri*.

3840. CUFODONTIS, G. Über die *Pittosporum*-Arten von Madagaskar. [**The *Pittosporum* species of Madagascar.**] *Phanérogamie* 15 (1), 1954 (14–32.) 29 refs. [G.] O.B.D.

Describes several new species, including one tree, *P. ambrense*.

3841. ARÈNES, J. **Rhizophoraceae madagascarienses novae**. *Phanérogamie* 15 (1), 1954 (1–4). [F.] O.B.D.

Petalodactylis, a new genus, is erected, with one species *P. obovata*, formerly included in *Dactylopetalum*. A new species of *Dactylopetalum*, *D. ellipticifolium*, is also described.

3842. ZOHARY, M.; LITWAK, M.; WAISEL, J.; KAPLAN, J.; CHUDNOFF, M. **Studies on *Tamarix articulata***. *La-Yaaran* 5 (1/2), 1955 (7–24, 41–2). 10 refs. [Heb.e.]

Contains a key in Hebrew to the one cultivated and 15 wild species of *Tamarix* in Palestine; a note on the increase of total soluble salts and Cl in soils under *T. articulata* [cf. *For. Abstr.* 16 (No. 3735)], relating high contents of these to leaf composition; and articles on propagation of *T. articulata*, its use in afforestation, and the characteristics and uses of its wood.

3843. SINCLAIR, J. **A revision of the Malayan Annonaceae**. *Gdns. Bull.* 14 (2), 1955 (149–516).

3844. WYATT-SMITH, J. **The Dipterocarpaceae of Brunei, N. Borneo and Sarawak. 1. *Anisoptera*.** *Malay. Forester* 18 (2), 1955 (70–9). 12 refs.

A field key to the species of *Anisoptera*, and descriptions of *A. costata*, *A. grossivenia*, *A. marginata*, *A. mindanensis*, and two unidentified species.

3845. SMITINAND, T. **Identification keys to genera and species of the Dipterocarpaceae of Thailand**. *Thai Forest Bulletin* (*Botany*), *Royal Forest Department*, *Bangkok* No. 1, 1954. pp. 32 + 2 photos. 21 refs. Price *R*.18.

3846. WYATT-SMITH, J. **Manual of Malayan timber trees. No. 6. Sapindaceae**. *Res. Pamphl. For. Res. Inst. Kepong* No. 6, 1954. pp. 2 + 23 + 3 sets of drawings.

[Cf. *For. Abstr.* 15 (No. 3282).] Describes the following species in detail: *Mischocarpus lessertianus*, *Nephelium glabrum*, *N. lappaceum*, *Pometia alnifolia*, *P. pinnata*, *P. ridleyi*, *Tristira penangensis*, *Xerospermum intermedium*, *X. laevigatum*.

3847. GAGNEPAIN, F. *Tardiella*, genre annamite nouveau de Canellacées. [***Tardiella*, a new Annamite genus of the Canellaceae.**] *Phanérogamie* 15 (1), 1954 (32–3). [F.] O.B.D.

3848. DUCHAIGNE, A., and CHALARD, A. DU. Contribution à l'étude du *Polyosma turfosa* Gagnep. et du *Polyosma nhatrangensis* Gagnep. (nouvelles Saxifragacées indochinoises). [**A study of *P. turfosa* and *P. nhatrangensis* (new Saxifragaceae from Indo-China).**] *Bull. Soc. bot. France* 102 (1/2), 1955 (1–6). 10 refs. [F.] O.B.D.

3849. WALKER, E. H. **Concerning the Myrsinaceae ('Ardisiaceae') of Japan. II. Some critical genera and subgeneric taxa**. *Bot. Mag., Tokyo* 67 (793/794), 1954 (155–62). [E.] I.M.I.

A critical examination of the nomenclature and subdivisions of *Maesa*, *Calispermum*, *Samara* and *Ardisia* (*Bladhia*). [Cf. *For. Abstr.* 4 (p. 96).]

3850. KOSTERMANS, A. J. G. H. **A monograph of the Asiatic, Malaysian, Australian and Pacific species of Mimosaceae, formerly included in *Pithecolobium* [*Pithecellobium*] Mart.** *Bulletin, Organization for Scientific Research in Indonesia, Djakarta* No. 20, 1954. pp. 122. [E.] L.S.

The genus *Pithecellobium* is split into several smaller genera; the reasons for this are discussed, and a historical survey of the genus is presented. *Pithecellobium sensu stricto* is represented in this area by one important species only, *P. dulce*. Newly described genera are: *Morolobium* (single species—*M. monopterum*), *Parasamanea* (single species, *P. landakensis*), *Serialbizzia* (2 species—*S. acle* and *S. splendens*), *Parenterolobium* (single species—*P. rosulatum*), *Cylindrokelupha* (3 species—*C. bubalina*, *C. balansae*, *C. havilandii*), *Paralbizzia* (3 species—*P. turgida*, *P. robinsonii* and *P. platycarpa*). The genus *Cathormion* is reinstated with 1 species, *C. umbellatum*. The genus *Zygia* is represented by 4 species, *Painteria* by 1 and *Abarema* by 44. *From author's summary*.

3851. BASTOS, H. DE MIRANDA. Contribuição para o conhecimento dendrológico das espécies de gênero *Centrolobium*. [**A contribution to the knowledge of *Centrolobium* spp.**] *Arq. Serv. flor., Brasil* 6, 1952 (125–86). 29 refs. [Port.]

Taxonomy, a study of the wood anatomy, some data on physical and mechanical properties, and methods of artificial regeneration.

3852. HERINGER, E. PAULO. Reabilitação de uma espécie de Fr. Velloso. [**Re-establishment of a species of Fr. Velloso.**] *Arq. Serv. flor., Brasil* 6, 1952 (197–200). 5 refs. [Port.]

Pterocarpus falcatus Vell., given in the Index Kewensis as synonymous with *Poecilanthe grandiflora* Benth. is described in Latin as a distinct species under the new combination *Poecilanthe falcata*. The characters of the two species are contrasted in a table.

3853. PEREIRA, E. Contribuição ao conhecimento da família Malpighiaceae. [**The family Malpighiaceae.**] *Arq. Serv. flor., Brasil* 7, 1953 (11–58 + 12 plates). 20 refs. [Port.]

Descriptions of the genera with a key, their occurrence in Brazil, distribution elsewhere in the Americas, significance of the generic names, synonymy, and uses—mainly of fruits and bark.

3854. FRIES, R. E. **A new *Malmea* species from British Guiana**. *Svensk bot. Tidskr.* 49 (1/2), 1955 (123–6). [E.] O.B.D.

M. guianensis a tree from British Guiana, systematically close to *M. obovata*.

3855. SMITH, C. E., JR. **The New World species of *Sloanea* (Elaeocarpaceae)**. *Contributions from the Gray Herbarium of Harvard University, Cambridge, Mass.* No. 175, 1954. pp. 114 + 3 plates. 25 refs. K.

Morphology, anatomy, range, and taxonomy with descriptions of species and a key.

3856. CUATRECASAS, J. **Taxonomic notes on neotropical trees.** *Trop. Woods* No. 101, 1955 (10–28).

Contains descriptions of 19 new species or varieties of trees chiefly from Colombia, and of the Anacardiaceae, Aquifoliaceae, Bombacaceae, Flacourtiaceae, Metteniusaceae, Olacaceae and Sabiaceae.

18. PLANT ECOLOGY

See also No. 4840.

181. *Mode of Life, Autecology. Silvicultural Characters of Trees*

See also Nos. 3846, 3946, 3963, 3979, 4107.

3857. GÖHRE, K., and WAGENKNECHT, E. Die Roteiche und ihr Holz. [***Quercus borealis* and its wood.**] Deutscher Bauernverlag, Berlin. 1955. pp. 300 + coloured plate. 131 refs. [G.g.] Price [£1. 10*s.* 5*d.*]

A monograph prepared at Eberswalde, supplementing and much extending Bauer's work in W. Germany [see *For. Abstr.* 14 (No. 3615)] and with special reference to plantings in E. Germany, in two parts: (1) Nomenclature, botanical characters; natural range; brief historical note on plantations in Germany; growth and yield; disorders, diseases and pests; silvicultural characters; seed collection and storage, nursery practice, planting and tending; place in German forests from the economic and silvicultural points of view; conclusions and summary of results of the study (*E. Wagenknecht*; pp. 13–181). (2) The wood—experimental material; structure; physical properties; strength properties; properties of rootwood; technological properties (hardness, abrasion resistance, fissibility, drying, impregnation, durability); influence of site on properties; comparison with wood of other species; uses; tabular summary of numerical values for different properties; general conclusions (*K. Göhre*; pp. 185–284). There are indexes to authors quoted, species, and subjects.

3858. LÁNYI, J. A vöröstölgy müszaki tulajdonságainak Összehasonlító vizsgálata. [**Comparative investigations on the technical properties of Red Oak [*Quercus borealis*].**] *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (153–64). [Hu.russ.e.g.]

Compared with other Oaks, it has proved fast growing and of superior form, even on poor sites. It seeds early and abundantly, and is little troubled by pests. The wood has good physical and strength properties except on poor soils, and a natural durability estimated to exceed 20 years; its timber may be considered almost as valuable as that of *Q. robur* and it should have a great future in Hungary.

3859. KAPPER, O. G. Rjabina obyknovennaja, ili gorjkaja. [***Sorbus aucuparia.***] *Lesn. Hoz.* 5 (8), 1952 (37–8). [Russ.]

A brief description, with special reference to seed, nursery practice, and the mechanical properties and uses of its timber. It has proved useful in shelterbelts, and can be used as an auxiliary species in coniferous and broadleaved plantations; it is also recommended for planting on a wide range of chernozems and as an underwood to Pine and Oak stands on fresh and moist soils. Being a soil improver it should be widely used as a second-storey tree on fresh soils. It is, however, badly damaged by deer and elk which may kill mature trees; it is also damaged by hares, especially when bent down by snow. Mention is also made of a *Sorbus* species ('nevežinskaja rjabina') a native of Ivanov Province (where several varieties are distinguished) the fruits of which have a vitamin-C content as high as that of orange or lemon, and which, on account of its frost resistance, is cultivated far outside its natural habitat.

3860. CREASY, W. D. **Secondary succession and growth of Yellow Poplar [*Liriodendron tulipifera*] on the 'Green Mountain', Nicholas County, West Virginia.** *Castanea* 19 (3), 1954 (81–7). 31 refs.

L. tulipifera owes its success in second-growth forest on moist, well drained soils to its comparative freedom from disease, rapid growth and ability to regenerate both vegetatively and from seed. On suitable soils it would appear an ideal tree for afforestation of old fields. It is highly intolerant of shade. Many trees in the area are as much as 100 ft. high at 50 years of age.

3861. LAMPRECHT, H. Saquisaqui. [***Bombacopsis sepium.***] *Bol. Ingen. for. Univ. los Andes.* 1 (6), 1954 [37–8]. [Span.]

Distribution in Venezuela and silvicultural characters.

181.1. Distribution, Natural Range

3862. GULISAŠVILI, V. Z. Zakonomernosti v rasprostranenii lesnoĭ rastiteljnosti i glavnyh drevesnyh porod v Zakavkazje. [**Regularities in the distribution of forest vegetation and of the chief tree species in Transcaucasia.**] *Bot. Ž.* 40 (1), 1955 (18–32). 27 refs. [Russ.]

Briefly discusses the horizontal and vertical distribution of the forest vegetation and its history, and gives more detailed notes, with sketchmaps, on the following species and the forest zones in which they occur: *Castanea sativa*, *Quercus iberica*, *Fagus orientalis*, *Picea orientalis*, *Abies nordmanniana*, *Quercus macranthera*, and *Pinus sylvestris* var. *hamata*. Differences in the zonation occur in passing from the W. to the E. and S. of the region.

3863. QURESHI, I. M. **A note on the distribution, geology, etc., of Sandalwood [*Santalum album*] in Bombay state.** *Indian For.* 81 (5), 1955 (318–21 + map).

181.2. Atmospheric Relations. Acclimatization

See also Nos. 3775, 3899, 3954 *et seq.*, 4068, 4174–6, 4185.

3864. GRAHAM, S. A. **Scoring [the shade-] tolerance of forest trees.** *Mich. For.* No. 4, 1954, pp. 2.

The shade-tolerance of trees may, the author claims, be consistently evaluated by assessing (3 grades each) (1) crown density, (2) leaf-bearing length/total length of branches, (3) crown length/total height of trees in a closed stand, and weighting the resulting score for (4) overstorey species, and (5) degree of shade-tolerance observed from other factors (mainly physiological). Scores vary from 10 for very tolerant to 0 for very intolerant species.

3865. GRÜLL, H., and WETTSTEIN, W. Photo- und thermoperiodische Einflüsse auf das Wachstum der Kiefer (*Pinus sylvestris*). **[Photoperiodic and thermoperiodic effects on the growth of *P. sylvestris*.]** *Holzforschung, Berlin* 9 (3), 1955 (81–4). 6 refs. [G.g.e.] P.R.

Seeds of *P. sylvestris* of 4 provenances (lat. 58° N., and 3 places between lat. 47 and 48° N. at 1000, 320 and 280 m.) were sown in Mariabrunn (lat. 48° 15′ N., 226 m.), and the plants measured after 4 years. Both in height increment and in photo- and thermoperiodic behaviour the plants reared from seeds of the high-altitude provenance were similar to those coming from the higher latitude. Results are graphed of the effects of thermoperiodism on growth during two consecutive years. [Cf. *For. Abstr.* 13 (Nos. 81–2).]

181.3. Water, Soil and Root Relations (including Bacterial and Mycorrhizal Symbiosis)

See also Nos. 3731–2, 3735, 3743, 3746, 3775–8, 3781–2, 3791–2, 3842, 3897, 3919, 3957, 3970, 4004–5, 4071, 4110, 4182–4, 4247, 4510.

3866. PARKER, J. **Available water in stems of some Rocky Mountain conifers.** *Bot. Gaz.* 115 (4), 1954 (380–5). 12 refs. O.B.D.

A further study in a series on drought-resistance in conifers [see *For. Abstr.* 14 (Nos. 160, 3032)]. Relative amounts of water were investigated in the various tissues supplying the foliage of Ponderosa Pine, Douglas Fir, Grand Fir and Red Cedar. Water content of terminal twigs per dry weight of needles growing above the point of severance, was higher in Ponderosa Pine than in the other 3 species studied, differences between these being insignificant. For all 4 species, the water contents of the twigs as a % of their dry weight were not significantly different and had little meaning for water availability to the needles. In all 4 species, defoliated branches 6 ft. long retained water longer than needle-bearing ones over a period of 3–5 days, as determined by sectioning the branches and determining the water content by oven-drying. Ponderosa Pine had the highest average water content in untreated freshly cut branches. Determinations of stem water content showed that heartwood water varied considerably from one species to another, that of Ponderosa Pine and Grand Fir being high and that of Douglas Fir and Red Cedar being quite low; total stem water was slightly higher in the two former than the two latter. The water content of stems in Douglas and Ponderosa Pine showed a definite annual cycle of increase and decrease, apparently depending on the weather. *From author's summary.*

3867. STONE, E. C., and FOWELLS, H. A. **Drought survival of Ponderosa Pine: seedlings treated with simulated dew survive by month non-treated controls in greenhouse test.** *California Agriculture, Berkeley* 8 (7), 1954 (9). L.S.

Experiments were undertaken to explore the possibility that the ability of Ponderosa Pine seedlings to survive on dry soils is due to their ability to absorb moisture from the air through the leaves. On each night of the experiment, the tops of Pine seedlings growing in soil too dry to support sunflower plants were exposed to artificial dew. Their survival was compared with that of an equal number of seedlings serving as controls, whose tops were not exposed to dew. The following conclusions were drawn: (1) Ponderosa Pine seedlings can survive longer than sunflower plants on a dry soil; (2) a fine mist spray at night, which should be comparable to dew, greatly lengthens the time the Pine can survive on soil at the ultimate wilting point of sunflower; and (3) the Pine seedlings can reduce the soil moisture below the point at which the sunflower wilts and dies, irrespective of whether the Pine seedling received dew at night or not. The mechanism by which the survival time of seedlings receiving spray at night was lengthened is not clear.

3868. ITO, E., INAGAWA, G., and KATO, K. **[Influence on the growth of Japanese Red and Black Pine seedlings of soil of different moisture.]** *Report of the Faculty of Agriculture, Shizuoka University, Iwata* No. 3, 1953 (144–52). 6 refs. [Jap.e.]

The growth of 1-year-old seedlings of *Pinus densiflora* and *P. thunbergii* put in a special container having 40 cm. of soil over sand and a water table kept at (1) 40, (2) 56, and (3) 95 cm. from the surface, was studied for 8 months, along with monthly records of soil moisture and temperature. Statistical analysis showed that the main significant difference was the poorer development of both species and of *P. densiflora* compared with *P. thunbergii*, in (3). Graphs and tables have English legends.

3869. SCHOLANDER, P. F., DAM, L. VAN, and SCHOLANDER, S. I. **Gas exchange in the roots of Mangroves.** *Amer. J. Bot.* 42 (1), 1955 (92–8). 12 refs. O.B.D.

Studies on *Rhizophora mangle* and *Avicennia nitida*.

3870. YAMAMOTO, T., and NAGAOKE, T. **[Studies of proper sites for Todo-fir in Hokkaido. VII. The soil of Todo-fir forest (*Abies mayriana*) in Kasai region.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (1–8). 6 refs. [Jap.jap.e.]

[Cf. *For. Abstr.* 16 (No. 2745).] Includes (in Japanese) 3 soil-profile descriptions and tables of soil characteristics by horizons, and correlates the growth of the *A. mayriana* (here outside its natural range) in plantations with soil type and climatic factors, both of which here influence its growth.

3871. OLIVEIRA, A. L. FRANCO DE. Considerações sobre os solos de montado (Sul do Tejo). **[The soils of Cork Oak stands south of the Tagus.]** *Bol. Junta nac. Cortiça, Lisboa* 17 (198), 1955 (151–8, XL–XLII, 31–3). 9 refs. [Port.e.f.]

Studies of soil profiles on a large number of soil types bearing Cork Oak in the region south of the Tagus show clearly that Cork Oak tolerates a wide variety of soils and also wide variations in soil depth. The most important reason (in addition to excessive pruning and thinning) for the poor state of the stands is the practice of frequent raking and burning of organic matter. The stands are often also managed for cereal cultivation and for grazing. The practice of 'morlia', which consists of mixing the plant residues with soil and beating them down before burning, has advantages over the normal practice of burning organic matter on the soil surface, in that it does not cause such excessive losses of N.

3872. Duchaufour, P. Les sols à peuplier. **[Poplar soils.]** *Rev. for. franç.* 7 (7), 1955 (539–46). 5 refs. [F.]

Examination of Populeta in different parts of France leads to conclusions on the fundamental importance of the summer groundwater level. Effective rooting depth is limited by this factor and, where it is high, Poplars (preferably cuttings) should be planted on mounds and spaced more widely to give more room for root development. Where the summer level of groundwater is low, on the other hand, plants should be set as low as possible so as to reduce the distance to be traversed by roots in order to reach permanent water.

3873. Stephens, J. E. M. **Tree growth on a seasonally dry swamp in eastern Uganda.** *E. Afr. agric. J.* 20 (4), 1955 (232–5). 2 refs.

Describes, with plant indicators, the phases of the catena neighbouring on a seasonal swamp as (*a*) grey swamp bottom, (*b*) grey seepage, (*c*) grey-fawn transitional, (*d*) degraded red earths of the ridges. *Cassia siamea* growth is best on (*a*) with little or no artificial drainage, becomes badly checked on (*b*) and (*c*), and is second-rate on (*d*). The rooting opportunity is poor in (*b*) and (*c*) because of permanent or growing-season water-logging and good in (*a*) because of deeply cracked clay subsoil. Root-growth in (*a*), (*b*) and (*c*) is illustrated diagrammatically, and nutrient and water status are discussed. For Eucalypts, (*a*) sites may require extensive drainage.

3874. De invloed van de zuurgraad (pH) van de grond op de ontwikkeling van verschillende gewassen. **[The effect of soil pH on the growth of various plants.]** *Jaarb. Proefsta. Boomkwek. Boskoop 1953*, [1954] (23–7). [Du.]

Includes tabulated figures showing diameter, height, and mortality of 1-year *Aesculus hippocastanum*, 2-year *Carpinus betulus*, and 1-year *Fagus sylvatica* for pH water values ranging from 4·35 to 7·0. Development of the 3 species was best for values of 5·5–7, 5·25–6·3 and 5·7 respectively. Tabulated figures are also given showing suitable pH values for a number of plants, including *Buxus sempervirens* (5·1–5·75), *Taxus baccata* (4·8–5·3) and *Thuja occidentalis pyramidalis* (5·0–5·4) on peat, and for *Acer platanoides* (6·0–6·65) and *A. pseudoplatanus* (6·8–7·15), *Betula* spp. (5·1–6·65), *Fraxinus excelsior* (6·0–6·65), *Quercus borealis* var. *maxima* (5·85–7·15) and *Q. robur* (5·5–6·65) on sand.

3875. Walker, L. C. **Influence of White Birch in restoring potassium to deficient soils.** *J. For.* 53 (6), 1955 (451–2). 4 refs.

Exchangeable K appears to increase in K-deficient sandy soils under the crowns of Birch; young White Pine under Birch show good growth, in contrast to those in adjacent openings, which show K-deficiency symptoms. [Cf. *For. Abstr.* 16 (No. 2756).]

3876. Bond, G., and Scott, G. D. **An examination of some symbiotic systems for fixation of nitrogen.** *Ann. Bot., Lond.* 19 (73), 1955 (67–77). 16 refs. O.R.E.

Isotopic nitrogen (N^{15}) was used in investigations of some symbiotic systems for the fixation of N. Positive results were obtained with two lichens and a liverwort, all of which are associated with the blue-green alga *Nostoc*; negative results were obtained with mycorrhizal roots of *Calluna vulgaris* and *Pinus sylvestris*.

3877. Oliveira, M. de, and Ventura, A. Ocorrência de micorriza em *Araucaria angustifolia* (Bertol.) O. Ktze. e *Podocarpus lamberti* Kl. **[The occurrence of mycorrhizae on *A. angustifolia* and *P. lambertii*.]** *Ediç. Prop. Serv. flor. Est. S. Paulo* No. 25, [1952]. pp. 5 + 5 plates. 7 refs. [Port.]

3878. Melin, E., and Nilsson, H. **Ca^{45} used as indicator of transport of cations to Pine seedlings by means of mycorrhizal mycelium.** *Svensk. bot. Tidskr.* 49 (1/2), 1955 (119–22). 5 refs. [E.] O.B.D.

[Cf. *For. Abstr.* 15 (No. 1173).] Describes experiments to investigate the transfer of metal ions to Pine roots through mycorrhizal hyphae. Radioactive Ca^{45} in the form of its chloride was chosen as a test material. The results show that considerable amounts of Ca^{45} ions were transferred by *Boletus* mycelia from a distant source to mycorrhizal roots, and from there were distributed throughout the seedlings.

3879. Harley, J. L., McCready, C. C., and Geddes, J. A. **The salt respiration of excised Beech mycorrhizas. 1. The development of the respiratory response to salts.** *Repr.* from *New Phytol.* 53 (3), 1954 (427–44). 7 refs. [Department of Botany, University of Oxford.]

When Beech mycorrhizae were kept in aerated distilled water for a period of several days, they developed the property of responding to the application of salts by increased O uptake and CO_2 emission. Both tissue systems, host and fungus, responded to salts in a qualitatively similar manner. The responses to the applications of phosphate and NH_4 salts were most marked. Salts containing other ions were less active in stimulating respiration. In every case studied, the magnitude of the response was dependent, over a very wide range, on the concentration of salt. The development of the property of responding to phosphate was not associated with the loss of that ion from the tissues, but depended upon some temperature-sensitive reaction that occurred in the tissues during storage.

Although during storage CO_2 was lost in respiration and salt response developed progressively, the maximum response was not associated with carbohydrate exhaustion by CO_2 production. The respiratory quotient of the roots fell during storage but rose immediately on the application of salts. When mycorrhizal roots were stored in 15-*mM* solutions of salts, response to phosphate was greatly diminished except in the early stages of storage. Storage in salt solutions did not affect the response to NH_4 salts so markedly, and in some cases increased it. Roots stored in glucose and sucrose solutions maintained a respiratory rate at a higher level than those stored in water. Sucrose feeding increased the respiratory response to both NH_4 and phosphate salts. Glucose feeding diminished the response to phosphate but increased the response to NH_4 salts. *From authors' summary.*

3880. Clowes, F. A. L. **The root cap of ectotrophic mycorrhizas.** *Repr.* from *New Phytol.* 53 (3), 1954 (525–9 + 1 photo). 16 refs.

A study of mycorrhizal roots of *Fagus sylvatica* suggests that root-cap cells are decomposed, probably by the mycorrhizal fungus, within the fungal mantle.

3881. Kalmár, Z. A kalaposgombák mykorrhiza-kapcsolatainak gyakorlati jelentösége. [**The practical importance of the mycorrhizal associations of hymenomycetes.**] *Erdész. Tud. Int. Évk.* 2, 1952 (1954) (277–91). 11 refs. [Hu.russ.e.g.]

A general discussion of the rôle of mycorrhizae in the nutrition particularly of tree seedlings, including observations on the differences that occur in the ectotrophic associations of hymenomycetes in forests under Continental conditions as compared with those of Northern countries. Some 120 fungus species forming symbiotic associations with one or more of 11 tree species in Hungary are tabulated. Contrary to evidence on the predominance of mycorrhizal associations with conifers in Northern forests, much greater numbers of associations were observed in Hungary with deciduous trees, the decreasing order of importance being: *Quercus*, *Fagus*, *Pinus*, *Castanea*, *Carpinus*, *Betula*, *Corylus*, *Larix* and *Populus*. Fungi forming permanent associations with more than two tree species are *Boletus scaber*, *B. rufus*, *B. edulis*, *B. regius*, *Amanita vaginata*, *A. rubescens* and *Russula cyanoxantha*, in addition to many other species occasionally observed to form associations with several species of trees. In contradiction to earlier reports, and possibly owing to the imperfections of laboratory methods of isolation, no assured mycorrhizal associations were observed in *Tilia*, whereas *Lactarius controversus* and occasionally *Boletus lividus* were found to form associations with *Alnus*.

3882. Kljušnik, P. I. O gribah, obrazujuščih mikorizu duba. [**Oak mycorrhizal fungi.**] *Lesn. Hoz.* 5 (8), 1952 (63–5). [Russ.]

A study of Oak mycorrhizae in different parts of the Ukraine on both chernozems and sandy soils showed that they were formed by several kinds of mycelium distinguishable by colour and morphology. Despite failure to produce sporophores in culture, the presence of *Hebeloma crustuliniforma*, *Scleroderma aurantium* and *Pisolithus arenarius* was demonstrated by comparison of underground mycelium bearing sporophores in nature with the mycorrhizal mycelium on Oak rootlets. As a check, acorns surface-sterilized with formalin were infected with spores of *H. crustuliniforma* and *S. aurantium*, stored for the winter in sterilized sand, and sown in spring 1950 in field soil also pretreated with formalin. By autumn mycorrhizal mycelia were present on 79% of the seedlings from acorns artificially infected with *H. crustuliniforma* and on 88% of those from acorns infected with *S. aurantium*; 13% of the controls developed mycorrhizae, owing presumably to incomplete sterilization of acorns and soil (acorns not inoculated but acorns and soil disinfected). Two further species—*Tricholoma lascivum* and *Cortinarius* sp.—were confirmed as mycorrhizal fungi (new for Oak) by growing Oak seedlings in jars of sterilized soil inoculated with pieces of freshly collected sporophores. The form in which mycorrhizal fungi are introduced when shelterbelt soils are inoculated with soil from Oak woods, was investigated by Holodnyĭ's soil-slide method [cf. *For. Abstr.* 15 (No. 2224)], using carefully washed pieces of glass (9 × 5 cm.) inserted in the soil and removed periodically for inspection under the microscope. It was found that mycelial growth progressed normally while the soil remained moist, but that, when it began to dry, the hyphae broke up and formed chlamydospores. It is mostly in this form that the fungi are doubtless introduced by soil inoculation. The rôle of basidiospores was studied by germinating, between two glass slides buried 5 cm. deep in the soil, basidiospores obtained from freshly collected sporophores of *H. crustuliniforma*. Microscopic examination showed that when spores arranged in clusters germinated, their germ-tubes united to form a single hypha, but the germ-tube of isolated spores grew into the nearest adjacent hypha. The basidially-developed mycelium had no clamp-connexions and was thinner than the ordinary mycelium, suggesting that the mycorrhizal fungi form two morphological kinds of mycelium, according to origin.

3883. Kardos, R. Az akác gyökérgumó—baktériumának függöleges és vízszintes irányú vándorlása a talajban. [**The vertical and horizontal movement of the bacteria of *Robinia pseudoacacia* root nodules.**] *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (133–8). 5 refs. [Hu.russ.e.g.]

Vertical movement was found to be confined to the upper 25–80 cm. of soil, horizontal, to a distance of 0·75–1·0 m., with a mean daily movement of ca. 1·6 cm. Inoculation of the soil between the rows of Robinia would therefore suffice, in cases where the seed had not been inoculated.

3884. Breviglieri, N., and Casini, E. Ricerche sul sistema radicale di *Cupressus macrocarpa* (Hartw.) in un filare frangivento. [**Study of the root system of a *C. macrocarpa* in a shelterbelt.**] *Monti e Boschi* 6 (4), 1955 (147–56). 23 refs. [It.f.e.]

Reviews the literature on, and describes the methods of investigating, the root systems of trees, and gives a detailed account of the excavation of the root system of a typical tree in a *C. macrocarpa* shelterbelt in the fruit-growing district of Viareggio.

3885. Scholtes, W. H. **The concentration of forest tree roots in the surface zone of some Piedmont soils.** *Proc. Iowa Acad. Sci.* 60, 1953 (243–59). 32 refs. A.P.B.

Presents the results of analyses in Loblolly Pine stands on fine-textured soil and Shortleaf Pine on coarse-textured soil. A positive correlation was found between the age of forest stands and the oven-dry weight of roots up to 0·10 in. in diameter. Root weight increases rapidly until the stands are some 20 years old, after which the rate of increase slows down, reaching a nearly constant value after 30 years. Significantly greater amounts of root are produced in fine soil than in coarse, owing to the greater moisture retention of the former. After about 60 years of age the surface soil is almost filled to capacity with roots; this may be a limiting factor in natural regeneration and in invasion by shallow-rooted species. *From author's summary.*

3886. Koščeev, A. L. Lesovodstvennoe značenie pridatočnyh korneĭ drevesnyh porod. [**The silvicultural significance of adventitious roots in woody species.**] *Lesn. Hoz.* 5 (9), 1952 (48–50). [Russ.]

Discusses the formation of adventitious roots by woody species, including (contrary to common belief) *Pinus sylvestris*. *Picea abies* has been found to form adventitious roots only up to an age of 40–45 years, which explains the dieback of mature Spruce on waterlogged sites. The author's observations on the formation of adventitious roots lead him to suggest that there is no danger in the deep planting of seedlings of species capable of forming them; if practised along with soil cultivation of planting patches, deep planting might reduce mortality in steppe plantations.

3887. Junovidov, A. P. K poznaniju vnutrividovyh vzaimootnošeniĭ v lesu. [**Intraspecific relationships in the forest.**] *Lesn. Hoz.* 5 (8), 1952 (11–3). [Russ.]

Studies in the Pine forests of the Borovoe reserve (N. Kazakhstan) showed that natural mortality leads to a group distribution of trees in the stand. Further study of root systems in stands of *Pinus sylvestris* (60–100 years) and of *Larix sibirica* showed that root-grafts usually occur between the trees in such groups. The %s of root-grafted 25- to 30-year-old trees in Borovoe Agricultural College Arboretum were: *Pinus sibirica* plots, 26; *Larix sibirica*, 30; and *Abies sibirica* up to 45%. These figures were determined from the number of live stumps (of trees felled in thinnings) that continued to grow in diameter. The author suggests that in untouched groups of root-grafted trees there is an exchange of nutrients between members of the groups which would explain the high survival %. That such exchange is possible, is confirmed by an experiment in which a Pine stem that was naturally grafted to two branches of a neighbouring tree, was severed below the union: after 19 years the severed stem and its crown were still alive. When some trees in a group with natural root-grafts were removed, the rest grew considerably faster. On the other hand, the growth rate of stumps is very small compared with that of the tree before felling, the annual rings being almost undiscernable by the naked eye; *L. sibirica* is, however, an exception, individual stumps showing an increment of 7·4 cm. in 22 years, i.e. a m.a.i. of 3·4 mm. The conclusion drawn is that group distribution and root grafting of trees of the same species assist them not only in competition with other species but also in withstanding various vicissitudes; had intraspecific competition existed, trees could not have grown in groups.

3888. Christensen, T. Rødel, *Alnus glutinosa* 'på stylter'. [**Stilt-rooted specimens of *A. glutinosa*.**] *Dansk dendrol. Årsskr.* 3, 1955 (213–23). 3 refs. [Dan.e.]

Mentions 3 modes of origin of stilt roots noted in literature (germination on tussocks, development of adventitious roots in accumulated litter at base of young trees, and soil subsidence after drainage) and describes a fourth mode believed to explain most of the examples seen in Denmark, viz. development of adventitious roots through rotting stools, which eventually moulder away, as a consequence of repeated coppice cutting. The process is shown in photographs.

181.4. Reaction to Biotic Influences (Competition etc.) and Fire

See Nos. 3887–8, 3897.

181.5. Reproductive Behaviour

See also Nos. 3786, 3788–90, 3830, 3867–8, 3946 *et seq.*, 4404.

3889. Leblanc, J.-H. **A mode of vegetative propagation in Black Spruce.** *Pulp Paper Mag. Can.* 56 (6), 1955 (146 . . . 153). (*Woodl. Sect. Index Canad. Pulp Paper Ass.* No. 1475 (F–2).)

Enumerates and illustrates the field characters distinguishing branch layers, seedlings and root suckers of *Picea mariana*. Many of the last showed 50 rings at ground level and never exceeded 3 ft. in height.

3890. Ozawa, J., Matsuura, T., and Matsuzaki, S. [**On the relationship between certain processes of the yield of Todo-fir seeds, especially flower-bud differentiation, flowering and seedbearing.**] *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (14–7). 8 refs. [Jap.jap.e.]

Two years' observations on *Abies mayriana* showed that the number of fertilizations was < 50% of the number of flower buds, but that 70–90% of the fertilizations produced seeds—a disparity attributed to the greater damage in winter by frost and birds than by insects in summer.

3891. Zobel, B. J., and Goddard, R. E. **Pine flowering and seed ripening in Texas.** *Res. Note Texas For. Serv.* No. 8, 1954. pp. 10.

Phenological data on *Pinus palustris, P. taeda, P. elliottii, P. echinata*, and × *P. sondereggeri*.

3892. Ščepotjev, F. L. O vtoričnom roste i vtoričnom cvetenii greckogo oreha. [**Lammas shoot growth and second flowering in *Juglans regia*.**] *Bot. Ž.* 40 (1), 1955 (116–25). 26 refs. [Russ.]

With particular reference to anomalies in leaves and flowers, including the production of bisexual flowers. Second flowering is common in years with late spring frosts which damage the ovaries of the first, normal flowering.

3893. Lawton, R. M. **The relationship between crown form and sex in *Chlorophora excelsa* (Welw.) Benth. and Hook. F.** *Emp. For. Rev.* 34 (2), 1955 (192–3 + 2 photos).

Preliminary investigations indicate that there may be a correlation, the ♂ tree having a small, compact crown, and the ♀ a large, open, rounded one. This may be a useful feature, since the sexes are otherwise difficult to distinguish when not in flower or fruit.

3894. Breviglieri, N. Ricerche sulla disseminazione e sulla germinazione del polline nel castagno. [**The dispersal and germination of pollen in *Castanea sativa* and *C. crenata*.**] *Pubbl. Cent. Stud. Castagno, Firenze* No. 2, 1955 (5–25). 9 refs. [It.it.f.e.g.]

In continuation of his previous studies of floral biology etc. [cf. *For. Abstr.* 13 (No. 3690)] the author reports on his investigation of pollen dispersal and germination. Large numbers of pollen grains (70,000–500,000 on a 50 × 50 cm. glass plate) were caught at distances of up to 300 m. from a flowering tree. The methods of catching and counting grains are described. Methods of artificial pollination and germination of pollen are described.

3895. Jaeger, P. Les aspects actuels du problème de la cheiroptérogamie. [**Present status of information on bat-pollination.**] *C.R. Conf. int. Afr. Ouest, Abidjan 1953*, [1954] (18). [F.]

Summary of a review article, citing 75 references, to which the author adds his own observations on the role of *Eidolon helvum* in the pollination of the Baobab.

3896. Vovk, P. Še o prirodnem obnavljanju jelke. [**Natural regeneration of Silver Fir.**] *Gozd. Vestn.* 13 (3), 1955 (76–84). [Sloven.]

The author knows many instances of Silver Fir trees growing out of decayed, or half-decayed, stumps, or broken or uprooted stems. The stumps often preserve their external appearance, so that the new shoots appear to be coppice growth. A 3-year-old natural-sown Fir was found growing out of a 35-cm.-high Fir stump; the seedling was only 7 cm. high but had a tap root 40 cm. long. There are many reasons why regeneration on decayed stumps or stems is more frequent with Spruce than with Silver Fir. Spruce seeds earlier (30 versus 50 years) and twice as frequently, has a higher (70–80 v. 30–50) and more lasting (3–5 years v. 6 months) germinative capacity; on the other hand, Fir seedlings on old stumps and stems have a better chance of survival, because the tap root eventually penetrates through into the soil, whereas the shallow root system of Spruce is often confined to the mass of the stump. This kind of natural regeneration is important in some primeval forests where the soil is either covered by raw acid humus or overgrown by mosses and lichens.

3897. Jakšina, A. M., and Gaelj, A. G. Estestvennoe vozobnovlenie sosny na peskah polupustynnogo Zavolžjja. [**Natural regeneration of Scots Pine on sands in the trans-Volga semidesert.**] *Bot. Ž.* 40 (1), 1955 (46–63). 13 refs. [Russ.] [Institut Lesa Akademii Nauk SSSR, Moskva.]

Gives an account of studies made in 1952–53 on small groups of natural regeneration in and round plantations on the Naryn sands, on the Volga/Ural watershed in western Kazakhstan. Of ca. 1000 ha. planted in 1893–1916 only 160 ha. of Pine, 5 ha. of *Alnus glutinosa* and 1 ha. of *Robinia pseudoacacia* and other species, now survive, the plantations having succeeded only in the damper hollows between the dunes. The paper describes the parent stands, planted 1912–1916, groups of reproduction of the period 1941–1948, and some special studies of differentiation of trees within such groups as regards growth and condition, and of root excavations. Conclusions are that regeneration of Pine and other woody species appears in and about moist depressions in wet years or in the 2–3 dry years immediately following, when the water-table is still high enough to influence surface moisture. The later fate of seedlings depends partly on site factors, e.g. sand movement, nutrient deficiency, drought, but also on relations between the trees themselves. Pine regeneration outside the influence of the canopy or root systems of adult stands has grown fairly well, reaching 3–5 m. (though with marked differentiation of growth within the groups) at 10 years old. Regeneration adjacent to old stands was more or less suppressed (seldom > 1·5 m. high at 10 years) owing to root competition. The rare patches of regeneration found within the adult stands were completely stunted and doomed to gradual extinction. In the last case the reduced light may play some part, but only in conjunction with the intense root competition from the old trees, which is the major factor causing suppression, whether inside or adjacent to the adult stands.

3898. Fenton, E. W. **Notes on the germination and early growth of Oak.** *Scot. For.* 9 (2), 1955 (65–7). 2 refs.

Notes on some unsystematic experiments on the germination of acorns and development and survival of seedlings. There was great variation (27–100%) in germination of acorns collected from different localities. Acorns gathered later than October did not germinate till the following spring. Much of the mortality of seedlings was apparently due to dry weather with drying winds. Shade and dampness appeared to be beneficial to young plants, which in these conditions retained all their leaves through the first winter.

3899. Black, M., and Wareing, P. F. **Growth studies in woody species. VII. Photoperiodic control of germination in *Betula pubescens* Ehrh.** *Physiol. Plant., Copenhagen* 8 (2), 1955 (300–16). 13 refs. [E.]

A full account and discussion of experiments already briefly reported in *Nature* [see *For. Abstr.* 16 (No. 1527)].

3900. HORVÁTH, E. Cserjék magérése és maghullása. **[Ripening and fall of shrub seeds.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (225–31). [Hu.russ.e.g.]

Tabulates the results of phenological observations on the ripening and seed-fall of 27 Hungarian species for the 7 years 1937–43, with the earliest and latest dates. For another 13 species less full data are given separately.

181.6. Life Form, Habit. Post-Seedling Development and Form

See also Nos. 3904, 3939, 4394, 4403–6.

3901. SHIPMAN, R. D., and RUDOLPH, V. J. **Factors influencing height growth of planted Yellow Poplar in southwestern Michigan.** *Tech. Bull. Mich. agric. Exp. Sta.* No. 242, 1954. pp. 44. 21 refs.

A study was made of soil, climatic, microclimatic, and microbiological factors contributing to the differential height growth in two portions of a 15-year-old plantation of *Liriodendron tulipifera*. Microclimatic factors, due to the presence in one case of an old-growth mixed hardwood stand on the south and west, were by far the most important, the sheltered area having better soil moisture, temperature, relative humidity, and protection from sun-scald.

3902. FARNSWORTH, C. E. **Observations on stem elongation in certain trees in the Western Adirondacks.** *Ecology* 36 (2), 1955 (285–92). 23 refs.

Data on length of growing period and amount of apical growth are given for *Picea abies*, *Pinus sylvestris*, *P. resinosa*, *P. nigra* var. *austriaca*, *P. strobus*, *Acer rubrum*, *A. saccharum* and *Prunus serotina*. [Cf. *For. Abstr.* 16 (No. 1531).]

181.7. Duration, Longevity, Stature; Records of Exceptional Age or Size. Effects of Age on Behaviour

See also No. 3826.

3903. KONEV, G. I. O prodolžiteljnosti žizni kedra sibirskogo. **[The longevity of *Pinus sibirica*.]** *Priroda, Moskva* 44 (2), 1955 (120). [Russ.] A.P.B.

During research on *P. sibirica* stands, both in the W. Siberian plain and the mountains (central Sayan and Baikal regions), the species has been found to be long-lived despite the adverse conditions of its habitats. Trees near Lombovozh, W. Siberia, were over 500 years old, though they showed crown die-back. The natural life of the species in its natural range may be put at 500–550 years.

181.8. Phenology

See also Nos. 3769–70, 3865–6, 3891–2, 3900, 3927, 4510.

3904. BALDWIN, H. I. **Course of seasonal height growth in European Larch.** *Fox For. Note* No. 60, 1955. pp. 1.

Weekly measurements on 55 trees, 8 years old, from seed from 11 different sources in Fox Forest, N.H. Elongation did not begin until a month after the needles were fully grown (29 April) and there was no measurable growth until the 1st week in June. Height growth continued until mid-Sept., averaging 108 days or 15 weeks compared with 12 weeks for native Larches.

3905. FAHN, A. **The development of the growth ring in wood of *Quercus infectoria* and *Pistacia lentiscus* in the hill region of Israel.** *Trop. Woods* No. 101, 1955 (52–9 + 2 photos). 9 refs.

Adds information on two more species to that formerly published [see *For. Abstr.* 14 (No. 2037)]. Vascular cambium division began in the Oak at the end of March and ceased at the end of August; in *Pistacia* the respective dates were the beginning of April and the end of Oct. to beginning of Nov. The protracted dry period May–Oct., rather than temperature, probably caused the cessation of cambial activity in both species.

181.9. Miscellaneous. (Including the Ecological Rôle after Death of Plants or Parts of Plants, e.g. Dead Trees, Stumps, Fallen Logs; for Litter see 114.351.)

See Nos. 3734, 3896.

182. *Synecology, Plant Sociology: General, Principles and Methods*

See also Nos. 3718–20.

182.1. Palaeoecology. History of Vegetation

3906. LEMÉE, G. L'évolution de la forêt française au cours du quaternaire d'après les analyses polliniques. **[The development of the French forest during the Quaternary period, as shown by pollen analyses.]** *Rev. for. franç.* 7 (6), 1955 (442–60). 29 refs. [F.]

3907. BOGOLEPOV, K. V. K voprosu ob ètapah razvitija tretičnoï rastiteljnosti v Priangarskoï časti Eniseiskogo krjaža. **[Stages of development of Tertiary vegetation in the Lower Angara region of the Yenisei ridge.]** *Dokl. Akad. Nauk SSSR* 100 (5), 1955 (985–8). 5 refs. [Russ.] A.P.B.

Pollen analyses show a succession from an Oligocene warm, moist optimum (40 genera) with Oak/Holly, Chestnut and many warm-temperate to subtropical species (both deciduous and coniferous), through Alder and Birch to Pine and then forest-steppe and steppe vegetation in (probably) the first half of the Pliocene.

3908. HEDBERG, O. **A pollen-analytical reconnaissance in tropical East Africa.** *Oikos* 5 (2), 1954 [1955] (137–66 + 5 plates). 27 refs. [E.e.]

During a recent expedition to Tropical East Africa the author studied the possibilities of utilizing pollen analysis in that part of the world. No pollen was found in soil or sediments formed under aerobic conditions, but large quantities were found in lake mud from the bottom of Lakes Victoria and Tanganyika and also in peat from a *Carex runs-*

soroensis bog in the alpine belt of Ruwenzori. From the latter was obtained a profile about 1 m. deep, which yielded a pollen diagram. In order to facilitate interpretation of pollen diagrams from high levels, the actual pollen spectrum was studied in a few plant communities at different altitudes on Mt. Kenya and Ruwenzori. Comparison of these spectra with each other and with the surrounding vegetation allowed some conclusions regarding the indicator value of the most important pollen types encountered. In the light of these conclusions the pollen diagram from Ruwenzori is discussed. Finally the prospects of pollen analysis in Tropical East Africa are briefly commented upon. *From author's summary.*

3909. HEUSSER, C. J. **Pollen profiles from Prince William Sound and southeastern Kenai Peninsula, Alaska.** *Ecology* 36 (2), 1955 (185–202). 58 refs.

182.2. Succession, Alternation and Periodicity in Vegetation

See also No. 3860.

3910. RICHARDS, P. W. **The secondary succession in the tropical rain forest.** *Science Progress, London* 43 (169), 1955 (45–57). 5 refs. L.S.

Discusses difficulties in distinguishing true primary from old secondary forest, the importance for silviculture and management of recognizing secondary forest and of understanding the change in progress, the wide variations in, and factors affecting these changes (illustrated by studies made in the Shasha Forest Reserve, Nigeria [see *For. Abstr.* 16 (No. 316)] and in Trinidad [see *For. Abstr.* 14 (No. 1084)]), reasons for an increase in secondary forest types within the last 100 years, and the importance of reaching a new equilibrium between man and the forests.

3911. MIÈGE, J. Relations entre savanes et forêts en basse Cote d'Ivoire. **[Relations between savanna and forest in the Lower Ivory Coast.]** *C.R. Conf. int. Afr. Ouest, Abidjan 1953,* [1954] (27–9). [F.]

Summary of a paper describing the advance of forest into savanna in relation to aspect, and the structure and composition of forest islands in shade and sun plants, with remarks on the Guava as a pioneer and on the ecology of *Borassus flabellifer.*

3912. KU, T. T. **Forest succession on the poorly-drained soils in the Higgins Lake area of Michigan.** *Abstr. of thesis,* in *Dissert. Abstr.* 15 (2), 1955 (186–7). [Michigan State College.] O.R.S.

The principal trend of succession is believed to be: marsh—swamp shrubs—swamp conifers—swamp hardwoods, and finally, after a long time, the upland mesophytic climax type of Hemlock/White Pine/northern hardwoods. The lowland Aspen type is thought to be the fire or temporary type after the original forest has been burned over or otherwise denuded. The swamp hardwoods, swamp conifers of *Thuja/Abies/Picea* and the marsh type, are all believed to be the physiographic subclimax type for the area.

3913. LAUFERSWEILER, J. D. **Changes with age in the proportion of the dominants in a Beech-Maple forest in central Ohio.** *Ohio J. Sci.* 55 (2), 1955 (73–80). 6 refs. C.G.B.

Change in numerical dominance from *Acer saccharum* to *Fagus grandifolia* occurs in the age group between 40 and 70 years; root suckering is the deciding factor in the maintenance of Beech dominance thereafter.

3914. NELSON, T. C. **Chestnut replacement in the Southern Highlands.** *Ecology* 36 (2), 1955 (352–3).

Castanea dentata killed by disease in N. Carolina is being replaced chiefly by former co-dominant species, but also to some extent by subordinate species, especially *Liriodendron tulipifera* [Cf. *For. Abstr.* 15 (No. 2355).]

182.4. Layer Communities

See also Nos. 3748, 3919.

3915. DUVIGNEAUD, P. Les Usnées barbues et le *Crossopterygo-usnetum* des savanes du Bas-Congo. **[The bearded *Usneas* and the *Crossopterygo-usnetum* of the Lower Congo savannas.]** *Bull. Soc. Bot. Belg.* 85 (1), 1952 (99–114). 5 refs. [F.] From *abstr.* in *Rapp. Inst. Rech. sci. Afr. cent., Bruxelles 1952,* 1955 (217–8). [F.]

[Cf. *For. Abstr.* 14 (No. 941).] A distinct association of the shrubby savannas of the Lower Congo is found where active erosion continually exposes the roots of the shrubs, which are almost exclusively hardy, stunted, root-suckering *Crossopteryx africana* and *Hymenocardia acida.* No fires occur, as no herbaceous layer can establish itself; lichens thus develop without hindrance, and bearded *Usneas* assume rapid dominance, covering the meagre branches with a dense green mantle with tresses > 1 m. long trailing on the ground. The association often indicates the approaching complete degradation of the soil, and the growth of the *Usnea* in full sun and wind shows that the air is relatively moist even in the 3–4 dry months, supporting Aubreville's separation of a special Angola/Lower-Congo climate on this account. Five species of *Usnea,* the growth of which is intermixed in these mantles, are named.

3916. CULBERSON, W. L. **The corticolous communities of lichens and bryophytes of northern Wisconsin.** *Ecol. Monogr.* 25 (2), 1955 (215–31). 27 refs.

3917. COOKE, W. B. **Fungi, lichens and mosses in relation to vascular plant communities in Eastern Washington and adjacent Idaho.** *Ecol. Monogr.* 25 (2), 1955 (119–80). 12 refs.

A study undertaken to discover what differences there might be in species composition, relative abundance, substratum preference etc. of fungi, lichens and mosses in 6 associations of 4 major vegetation zones (grass, Ponderosa Pine, Douglas Fir, *Thuja/Tsuga*). The lichen flora of the prairie vegetation (grassland and shrub associations) is poor in comparison with the forest associations. At low altitudes the impoverishment is almost as striking in fungi but not in mosses.

3918. TAKAKI, N. **Contributions to the moss flora of mountainous districts in central Japan II.** *Bot. Mag., Tokyo* 67 (793/794), 1954 (167–71). [E.] I.M.I.

Notes on the distribution and habitats of 26 species of *Mnium* in the following types (upper altitudinal limits in m.): coastal evergreen broad-leaved; deciduous broadleaved (1600); conifer (2500); shrub (2800); grass (3000); subnival (> ca. 3000).

182.5. Synecological Measurements and Methods

See Nos. 3936, 3940–1, 4168, 4386.

182.8. Ecology of Artificial (Cultivated) Plant Communities etc.

3919. TURY, E. A szikes talajok ligetes erdöi. **[The grove-like forests of the alkaline ('szik') soils.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (43–57). [Hu.russ.e.g.]

An ecological study of the Hortobágy Oak plantation near Óhat shows that, while the chemical composition of the soil has not changed in 30 years, the open tree stands have encouraged a sward of valuable grass species, productive even in drought years. The Oak roots cannot penetrate soils of > 0·2% soda content.

187. *Vegetation Types*

See also Nos. 3718–20, 3723, 3740, 3862, 3910–9, 3936, 4057, 4059–60, 4838.

3920. CORONA, E. Introduzione allo studio del *Pinetum silvestris sub-illyricum* delle Giudicarie (Trentino). **[The *Pinetum silvestris sub-illyricum* of the Giudicarie (Trentino).]** *Monti e Boschi* 6 (3), 1955 (131–6). [It.f.e.]

An ecological study.

3921. BANTI, G. Stazioni di *Buxus sempervirens* in Val Graveglia (Appennino genovese). **[*B. sempervirens* sites in Val Graveglio (Genoese Apennines).]** *Nuovo G. bot. ital.* (*n.s.*) 61 (1), 1954 (38–66). 6 refs. [It.it.f.] A.P.B.

Describes the associations in which Box occurs naturally in this area.

3922. SAHNI, K. C., and RAIZADA, M. B. **Observations on the vegetation of Panch Chulhi. [N.E. Kumaon, India].** *Indian For.* 81 (5), 1955 (300–17 + 5 photos + 2 maps).

Vegetation types described are: Cypress (*Cupressus torulosa*) forest, mixed forest, Fir [*Abies pindrow*] forest, high level Fir [*A. spectabilis*] and Birch [*Betula utilis*] forest, alpine scrub, and alpine meadow.

3923. SETH, S. K. **A short note on *Sporoboletem* [*sic*] grasslands of Uttar Pradesh.** *Indian For.* 81 (3), 1955 (185–90).

3924. MOHAN, N. P. **Grasses of the Punjab according to forest types.** *Indian For.* 81 (3), 1955 (179–84).

An attempt is made to prepare lists of grasses corresponding with Champion's forest types.

3925. AUBRÉVILLE, A. La typologie topographique forestière. **[Topographical forest typology.]** *Bois For. Trop.* No. 41, 1955 (3–7). [F.]

The aerial survey of tropical forests reveals types based on topography, that were not clearly shown by ground surveys. As a result of visual reconnaissance and study of air photographs in Madagascar and West Africa, the author makes some tentative contributions to a typology based on topographical factors: (1) *Dotted dense forest* ('forêt dense tachetée') is very widespread in the middle Ivory Coast, on the border between savanna and tropical forest. The peneplain is dissected by a network of gallery forest, and in the centre of each topographical cell bounded by the forest lines of the *thalwegs*, is a nucleus of forest isolated from the galleries by a border of savanna. (Three variations of this type are illustrated by air photographs.) This type of forest occupies the summits of small plateaux, while the surrounding slopes are savanna. (2) *Digitate forest* ('forêt digitée') is the opposite to (1) in that it occupies the depressions in the relief, while the higher parts (hillocks, plateaux etc.) are savanna. It has a highly ramified appearance from the air, and is common in the middle and lower Congo and in parts of Madagascar, on plateaux dissected by recent erosion. (3) *Wooded cirques* ('cirques boisés') are found where landslides occur on the slopes of hills, and the resulting cavities are rapidly filled with forest vegetation. This type of erosion is common on certain sedimentary soils in Gabon, middle and southern Congo, and especially in Madagascar. (4) *Valley forests* are widespread in the region of the Kalahari plateaux of the southern Congo, which are traversed from north to south by numerous parallel affluents of the Congo. The valleys, sometimes of a considerable width, are filled with forest, but it ends abruptly at the edge of the plateaux, which carry treeless savanna. (5) *Ridge forest* ('forêt de crêtes') occurs in Mayumbe, where the upper parts of the hills are covered with forest, leaving their bases bare. (6) *Dotted open forest* ('forêt claire tachetée'), which occurs in the middle of the Ivory Coast, resembles (1) but with open *Isoberlinia*/*Uapaca* instead of dense semi-evergreen forest. (7) *Tiger scrub* ('scrub tigré') is a curious vegetation pattern observed in the Sudan, Nigeria, Italian Somaliland and northern Arabia. It is a type of the pre-desert region and displays dark bands of shrubby vegetation alternating with light bands of bare soil, the bands curving inwards more or less, giving the appearance of contour lines traced on the ground. They are sometimes practically concentric. (8) *Striped scrub* ('scrub ridé') was observed when flying over the Gold Coast between Accra and Takoradi. The littoral savanna was traversed by dark rectilinear bands, parallel to one another and oblique to the coastline, of varying width and discontinuous. They consisted of some kind of scrub. This pattern was quite different from (7). (9) *Clump savanna* ('savanes à boqueteaux') is a natural formation, where the forest vegetation is concentrated in little black spots when seen from an airplane. (10) *Savanna with bushes on termite mounds* ('savane à buissons sur termitières') is common in Uganda. The grassy savanna is dotted

with termite mounds, each of which is topped by a bushy clump of shrubs, creepers etc. Each mound is surrounded by bare soil and appears from the air as a black dot in the middle of a light-coloured ring. (11) *Littoral scrub*, when detached from the forest of the interior, forms a narrow band, following the coastline exactly. (12) *Mosaic facies* is common in forests recently occupied and in course of clearing.

3926. BEARD, J. S. **A note on gallery forests.** *Ecology* 36 (2), 1955 (339–40). 3 refs.

Discusses the occurrence of gallery forests along watercourses in savanna areas of tropical America and concludes that they are confined to recent alluvia and represent the climatic climax of the region, the savanna being of edaphic origin.

3927. FILHO, O. DO A. GURGEL. Observações e estudos sôbre o cerrado da zona média Mogiana, com especial referência a algumas essências que aí proliferam. **[Studies of the 'campos cerrados' of the middle Mogiana region, with special reference to some species growing there.]** *Ediç. Prop. Serv. flor. Est. S. Paulo* No. 13, 1951. pp. 7 + 5 plates + 1 tbl. [Port.]

Notes on vegetation, soils, water régime, effects of fires, exploitation, possibilities for reforestation, experiments in raising Eucalypts and some plants native to the 'cerrados', with phenological observations, over a period of 4 years, on 16 native species.

3928. NEWMAN, J. C. **Tumut catchment area: survey of vegetation and erosion.** *J. Soil Conserv. Serv. N.S.W.* 10 (4), 1954 (204–13); 11 (1; 2), 1955 (48–61; 95–111).

The vegetation is discussed under the heads: Alpine Complex; Sub-alpine Complex; *Eucalyptus pauciflora* alliance; *E. stellulata*/*E. camphora* alliance; *E. robertsoni* alliance; *E. gigantea* alliance; *E. dives* alliance; *E. blakelyi*/*E. melliodora*/*E. stuartiana* alliance.

2. SILVICULTURE

See also Nos. 3718–20, 3857, 3859, 4427, 4851.

3929. BARNARD, R. C. **A manual of Malayan silviculture for inland lowland forests. Part 1. A brief history of Malayan silviculture. Part 3. Natural regeneration. Part 4. Artificial regeneration.** *Res. Pamphl. For. Res. Inst., Kepong* No. 14, 1954. pp. 199.

A first instalment (in mimeo form) of a projected complete manual.

3930. WILTEN, W. Aspects de la sylviculture au Mayumbe. **[Silviculture at Mayumbe [Lower Congo].]** *Bull. agric. Congo belge* 46 (2), 1955 (319–28). [F.flem.]

[Cf. *For. Abstr.* 8 (No. 1691).] Methods of raising *Terminalia superba* at Mayumbe are (*a*) pure plantations, (*b*) enrichment by strips, and (*c*) *taungya* with bananas. Detailed costs in man-days for each are given. Cleaning, girdling and felling rules for (*b*) are brought up to date, and (*c*) is described in detail. Final spacing recommended is 12–15 m., involving a modification in (*b*) planted 20 × 5 m. and (*c*) 12 × 8 m., the latter indicating one thinning of alternate plants. The species has varieties capable of clean bole growth in open situations.

3931. SANGER, O. J. **The Chilterns Project.** *Quart. J. For.* 49 (2), 1955 (85–90). 12 refs.

Paper read to the British Association Sept. 1954, describing the origin and present status of this investigation into the management and silviculture of Beech in the Chilterns and making some suggestions for enriching pure Beech by suitable mixtures. [Cf. *For. Abstr.* 13 (Nos. 2847, 3735).]

3932. BUCKINGHAMSHIRE, EARL OF. **Reactions of the private owner to the Chilterns Project.** *Quart. J. For.* 49 (2), 1955 (93–100).

Paper read to the British Association, 1954, as part of a symposium on the Chilterns Project.

3933. ŠEVČENKO, S. V. Prikarpatskie pihtovye dubravy i puti ih vosstanovlenija. **[Silver Fir/Oak stands of the Carpathian foothills, and methods for their restoration.]** *Lesn. Hoz.* 5 (9), 1952 (50–2). [Russ.]

Discusses the importance of preserving, at the 550–600 m. level, Oak/Silver Fir stands, not only on account of the valuable large timber they yield but also because Silver Fir is a good auxiliary species for the Oak. Such mixed stands should be worked by a simplified form of uniform system, the principal fellings being carried out in two operations, or by clear fellings preceded by silvicultural operations aimed at assisting natural Oak regeneration. It is important that the young growth at the time of felling should not exceed 0·5 m., as otherwise a change of species tends to take place. In pure Silver Fir stands where there is, as a rule, sufficient natural regeneration, Oak should be introduced on clear-felled areas by planting at 5000/ha., while in pure Oak stands up to 50 years old it is the Silver Fir that should be introduced; this is best achieved by 'nest' sowing (1000 nests of 5 seed spots each, per ha.). In Oak/Silver Fir stands, the Oak should be favoured in the course of tending operations, by the removal of secondary species, shrubs and part of the oldest natural Fir regeneration.

3934. MOSS, A. **Lodgepole Pine in the Okanagan Valley [British Columbia].** *Scot. For.* 9 (2), 1955 (67–72).

Describes the silvicultural character of the species, the nature of these stands (fire sub-climax, dense and whippy) and the silvicultural problems that they present, with some discussion of possible utilization of the wood, which is at present of little economic value.

22. SILVICULTURAL SYSTEMS. CONSTITUTION AND COMPOSITION OF STANDS; FORMS OF STAND

221. *High Forest Systems*

See also Nos. 4082, 4125, 4172.

3935. FRASER, J. W., and FARRAR, J. L. **Strip-cutting in a mixed Pine stand.** *Tech. Note For. Br. Can.* No. 1, 1955. pp. 17. 2 refs.

A mixed stand of Pine with an 80-year-old Jack Pine overstorey, and a 47-year-old understorey of Red and White Pine, was clear cut in one-chain-wide and two-chain-wide strips at the Petawawa Forest Experiment Station in 1934. The clear-cut strips were at right angles to the prevailing winds and separated by chain-wide uncut strips which were eventually cut over in 1942 for poles and sawlogs. The influx and development of White Pine reproduction was studied on the basis of number of seedlings per acre on two permanent sample plots. A stocking survey was also conducted on both clear-cut and partially-cut strips in 1949, and the date of origin of all classes of seedlings was established by a height/age survey in 1950. The clear-cut strips and their associated intervals were at least 60% stocked with White Pine seedlings in 1949. The one-chain-wide strips and intervals were better stocked than the two-chain-wide strips and intervals, and the seedlings were better developed. This better stocking is attributed to the more abundant seed supply and better seedbed conditions rather than to the width of the strip. The better development of the regeneration on the chain-wide cuts and intervals is attributed to width of strip (through its relation to absence of weeviling and browsing, which were repeatedly severe on the wider cuts and intervals), and to less vigorous shrub growth. Seedlings $> 2\frac{1}{2}$ ft. high 15 years after cutting were shown to have been present prior to the treatment; as seedlings provided the greater part of the stocking, the major effect of the cutting was one of release. The success of this cutting technique, therefore, was dependent largely upon the existence of seedlings prior to cutting. Where such crops exist on a sandy site with a satisfactory distribution and frequency, any cutting technique that encourages their release and minimizes the dangers attendant upon vigorous White Pine seedling growth should be satisfactory. Although strip-cutting is here shown to have been effective on light sandy soil, it is suggested that it would be less successful on heavier soils. Furthermore, any method such as a shelterwood cutting that would open up the stand moderately, would probably have been equally successful. *From authors' summary.*

3936. ROSAYRO, R. A. DE. **The silviculture and management of tropical rain forest with special reference to Ceylon.** *Ceylon For.* (*n.s.*) 2 (1), 1955 (5–26). 20 refs.

While in many countries of the British Commonwealth there is a tendency towards the abandonment of selective working in tropical rain forest, and the adoption of clear felling or tropical shelterwood systems, many countries in S.E. Asia continue to adopt a modified selective system. In Ceylon, ecological studies based on earlier 1% sampling combined with recent statistically acceptable 5% sampling of all tree species (over 4 in. diameter) have demonstrated the close correlation that exists between ecological types and the composition of the stock as expressed in number of trees and b.a./acre of the principal economic types, viz. primary hardwoods and light hardwoods, secondary hardwoods and light hardwoods, and fuel species. Analyses of the results of enumeration, supported by histograms of stock (by numbers of trees and b.a.), indicate that the primary *Mesua/Shorea/Doona* high-forest type is comparable directly with other tropical virgin rain-forest types, and also with European selection forest. Similar data are examined for the *Dipterocarpus* community and *Vitex/Wormia/Chaetocarpus/Anisophyllea/Dillenia* secondary forest type. On the results of these analyses, a modified form of selection forestry based on the 'méthode du contrôle' is outlined which will be adopted for the primary high-forest type containing selection or potentially selection stocking. Other forest types, also on the basis of these analyses, will be treated by an irregular shelterwood system. *From author's summary.*

3937. ŠAFAR, J. Problem njege mladog naraštaja u prebornim šumama. **[The problem of tending young growth in selection forests.]** *Šum. List* 78 (11/12), 1954 (561–70). 21 refs. [Croat.croat.g.]

The following conclusions are drawn from the available European data obtained in Silver-Fir/Beech selection forests (particularly in *Fagetum abietetosum*, and partly in *Blechno-Abietetum*): Young Fir and Beech show better development in groups than as scattered trees. Uniform, heavy opening of the canopy favours regeneration of Beech; Fir regenerates better under an irregular, but closer canopy. The regeneration of conifers should be supplemented artificially by group planting and sowing. Where Beech has established itself, it should be left, since it creates a new biocoenosis within which Fir is likely to regenerate better in the future. Under a closed canopy, regeneration occurs as single stems or groups, while under a relatively open canopy it develops *en masse*.

3938. LAFOND, A. **Industrial silvicultural treatments—their cost.** *Pulp Paper Mag. Can.* 56 (6), 1955 (168 . . . 172). (*Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1469 (*F*–2).)

Details the costs and yields under a 10-year cycle of partial cutting [selection system?] in a pilot area of uneven-aged Balsam Fir (*Cornus-Oxalis* type). Though harvesting costs are increased 11% over clear felling, the increase in yield (66%) more than compensates. Other advantages are cheaper wood production, better sanitation and fire protection, the improvement of the crop, and more stable labour conditions. All sites should be classified by ground flora and potential yield. Results to date seem to warrant the application of the system to all favourable areas.

3939. ALEKSEEV, S. V., and MOLČANOV, A. A. Vyboročnye rubki v lesah Severa. **[Selective logging in the Northern forests [of Russia].]** Institut Lesa,

Akademija Nauk SSSR, Moscow. 1954. pp. 148. 26 refs. [Russ.] Price *Roubles* 8·60.

Gives a detailed account of the effects of felling mature and over-mature coniferous stands in the Obozersk district, Archangel, to d.b.h. limits of 22, 27, 31 or 36 cm. The annual felling areas measured 0·25 × 2 or 0·13 × 2 km., 32 such areas being cut over during the 4 years 1924–27. The results cover a first enumeration of sample plots 1 year before felling, and subsequent enumerations (all trees ⩾ 6 cm. d.b.h. were numbered) during the 15 years after felling. The chapters deal with: (1) History of the problem. (2) The fellings and method of study. (3) Growth in closed Scots Pine stands not subjected to selective felling. (4) Intensity of selective felling. (5) Adaptation of the residual stands to the changed conditions brought about by the fellings. (6) Influence of the fellings on growth and resistance to injuries in *Pineta hylocomiosa*: (*a*) even-aged Pine and understorey of Norway Spruce (plus some Siberian Larch and Birch); (*b*) uneven-aged Pine, with the same associates, containing either 2 or 3 generations of Pine. (7) Timber defects in stands before felling. (8) Influence of fellings on defects. (9) Growth in untouched *Piceeta hylocomiosa*. (10) Influence of fellings on *Piceeta hylocomiosa*: (*a*) even-aged; (*b*) uneven-aged. (11) Natural regeneration on felling areas. (12) Seed-bearing in selectively felled stands.

Conclusions vary with the varied stand conditions represented, but in general it may be said that: (1) In even-aged Pine, selective felling encourages succession to Spruce as the dominant, needs great caution, and is applicable only where it is imperative to maintain forest cover during the regeneration period. Selective fellings in uneven-aged Pine, however, may be more advantageous than clear felling. (2) In Spruce, the effects of selective felling vary greatly with stand constitution and especially age. Old even-aged Spruce (160 years) suffers very high mortality, whereas stands 130 years old are scarcely or not at all adversely affected. Age structure is also the most important factor determining the reaction of uneven-aged Spruce: the higher the proportion of the younger generations, the better is the result of selective felling as judged by increment and mortality following a given intensity of felling.

226. *Changes of Silvicultural System. Conversion (by System or Species)*

See No. 4049.

228. *Constitution and Composition of Stands; Choice of Species and Form of Mixture; Tree Classes; Forms of Stand*

See also Nos. 3718, 3739, 3744, 3864, 3935, 4069, 4428.

3940. VESTAL, A. G. **Composition diagrams for forests.** *Transactions of the Illinois State Academy of Science, Springfield* 46, 1953 (31–6). 4 refs. L.S.

Describes and illustrates a method of showing species and basal area distribution in diagrammatic form.

3941. VESTAL, A. G. **Diagrams to show which species occur in particular plots or stands.** *Transactions of the Illinois State Academy of Science, Springfield* 46, 1953 (37–40). 3 refs. L.S.

A simple method of showing species representation based on a geometric pattern of a few rows of circles, in which each species (represented by a circle) is assigned a particular position.

3942. BADRÉ, L. Les sapinières sèches des Vosges Haut-Rhinoises. **[The dry Fir stands of the Vosges in the department of Haut-Rhin.]** *Bull. Soc. for. Franche-Comté* 28 (5), 1955 (229–40). [F.]

These sparse stands, dominated by Silver Fir now in a state of regression, arose naturally by the invasion of old Oak coppice with some Scots Pine. Once the Oak and Pine were removed, the Fir began to suffer from the disadvantages of low altitude and, especially, deficient precipitation. Increment falls off rapidly after an age of ca. 100. Possible methods of treatment are discussed, and the policy actually adopted by the forest service is outlined, viz: to harvest the Fir and replace it by immediate planting, with the aim of producing a mixed uneven-aged forest containing some Fir on the moister sites, but consisting mainly of Scots Pine, with varying proportions of Larch, Douglas Fir, Corsican Pine, *Abies nordmanniana*, Norway Spruce, and some 20–30% of hardwoods in intimate mixture for purely silvicultural reasons.

3943. BALDWIN, H. I. **Growth of an old Red Pine/White Pine stand.** *Fox For. Note* No. 57, 1955. pp. 1.

Measurements were made in 1940, 1946 and 1954 of a mixed, nearly even-aged stand of *Pinus resinosa* and *P. strobus*, now ca. 120 years old. *P. resinosa* grew at about half the rate of *P. strobus* in each period, and though growth rate declined in both species in the second period (1946–54), *P. resinosa* declined more than *P. strobus*. This capacity of *P. strobus* to continue growth after 100 years, its greater tolerance of shade, and heavier and more frequent seeding indicate that it can supplant *P. resinosa* that grew faster in youth.

3944. RUDOLPH, V. J., and LEMMIEN, W. **Growth of a mixed Red and White Pine plantation in the Kellogg Forest.** *Quart. Bull. Mich. agric. Exp. Sta.* 37 (3), 1955 (412–9). 8 refs.

Examination of a 20-year-old mixed stand leads the authors to conclude that, contrary to the usual view, the site would be more profitably occupied by *Pinus resinosa* alone. This now has 2½ times the volume per acre of *P. strobus*. The reason why previous writers have held an opposite opinion is that they based their conclusions on measurement of a small number of dominant trees instead of measuring all trees. [Cf. *For. Abstr.* 13 (No. 2119), 15 (No. 2748).]

3945. FRÖHLICH, J. Urwaldpraxis. **[Practical forestry in the virgin forest.]** Neumann Verlag, Radebeul and Berlin. 1954. pp. 200 + 36 plates. Many refs. [G.] Price *DM*.12·50.

A descriptive summary of the author's 40 years of experience in the virgin forest areas of S.E. Europe

(chiefly Jugoslavia and E. Carpathian regions of Rumania and Poland) as a practising forester. The main chapters deal with: the term 'virgin forest'; the chief tree species of such forest in S.E. Europe (Silver Fir; Beech, Ash, Maple, Elm; Norway Spruce; Oak; Scots and Austrian Pines); the age and course of growth of individual trees; exploitation to date, and its effects; virgin compared with selection forest (concluding that the modern managed selection forest has little in common with virgin forest); felling and storage of logs; timber extraction and its history; pests, diseases and wood defects in virgin forest; natural and artificial regeneration; mensuration and the introduction of management; mixed and pure stands (stressing the justification of the latter where they are natural). Two final chapters contain notes on virgin forest in N.W. Anatolia and Abyssinia, and an appendix gives data from a number of sample plots in S.E. Europe and Anatolia. The whole is written against the background of the progressive disappearance of virgin forests and the possible lessons for practice in managed forests.

23. REGENERATION AND FORMATION OF STANDS

3946. RATJKOVSKIĬ, S. P. Lesa eli tjanjšanskoĭ i ih vosstanovlenie. [***Picea schrenkiana* forests and their restoration.**] *Lesn. Hoz.* 5 (9), 1952 (52–5). [Russ.]

In the mountains of Kirgizia and Kazakhstan *P. schrenkiana* is important for both soil protection and timber. It does not descend into the plain, but grows mainly on steep northern slopes at altitudes of 1000–3200 m., seldom in extensive blocks, but mostly in pure groups of 3–10 ha. or in strips up and down the slope. Natural regeneration is almost completely absent, age classes I–III are very poorly represented, and most of the trees belong to the mature classes. During the first 40 years, *P. schrenkiana* grows very slowly, reaching a mean height of only 9·4 m.; thereafter, growth improves considerably, and at 156 years the mean height is 32·6 m. The rotation should be between 100 and 200 years and stands $>$ 120 years old are regarded as over-mature. Seedbearing begins at 40–65 years, according to altitude. The seedlings suffer from insolation and from late frosts, so that regeneration tends to occur under the shelter of shrubs, e.g. *Lonicera*, *Salix* and *Sorbus*, and at lower levels under Aspen and, locally, Birch; at higher levels it regenerates among *Juniperus*. Attempts to raise *P. schrenkiana* in nurseries and by direct sowing have given poor results, the young seedlings perishing from an unidentified disease. On the other hand, 5- to 12-year-old wildings transplant well and up to 90% survival has been obtained. Natural regeneration occurs mostly where the subsoil is laid bare, and also on poor rubbly or gravelly soils. The soil under *P. schrenkiana* is characterized by a high humus content (11–24%) of which only a small fraction is soluble in water (0·37–0·54%); the high humus and fine-earth contents produce a soil with a very high water-absorbing capacity which becomes saturated during the rains, causing the regeneration to perish from lack of oxygen. Using only the small amount of water-soluble humus held in the soil, *P. schrenkiana* does not require fertile soils; it grows best on acid or neutral soils derived from gneiss, granite etc. Nurseries should be established on coarse sands etc. with pH $\leqslant$ 6·8. It has been observed that in nurseries on fertile soils seedling survival was as low as 25/ sq. m., while in those on poor rubbly soils it reached 95/sq. m. In order to improve existing stands, 4- to 12-year wildings should be used for beeting and 2- to 3-year nursery stock for planting in places where shrubs provide shelter.

231. *Natural Regeneration*

See also Nos. 3896–7, 3935, 3937, 3939, 3946, 3984.

3947. MURI, G. **The effect of simulated slash burning on germination, primary survival and top/root ratios of Engelmann Spruce and Alpine Fir.** *Res. Note U.B.C. For. Club* No. 14, 1955. pp. 7. 6 refs.

Results of seedbed preparation by controlled burning have so far been very variable in Spruce/Fir forests of the interior of British Columbia. The purpose of this study was to evaluate in the greenhouse the effects of degree of burning (amount of ash) and degree of leaching (amount of precipitation after burning) on germination, primary survival, and top/root ratios of (*a*) *Picea engelmannii* and (*b*) *Abies lasiocarpa*. The following tentative conclusions were reached: (1) Ashes had little effect when seeds were properly stratified, sown to a depth of 0·1 in., and kept well watered after sowing. (2) Survival on ash-covered seedbeds was about half that on unburned seedbeds. Relatively more (*a*) than (*b*) survived on burned surfaces. There was no consistent effect of degree of burning or leaching on survival. Damping off was probably favoured by the higher pH of burned seedbeds (unburned 4·9, burned 7·2). The chief causes of mortality on burned seedbeds were damping off and the difficulty that seedlings had in penetrating the seedbed surface after germination. (3) After two months, (*a*) had put less dry matter than (*b*) into growth of tops: their average top/root ratios were 3·0 and 3·7 respectively and at 3 months 1·2 and 2·2. There was no difference between average ratios on burned and unburned seedbeds. (4) In general it might be concluded that (*a*) had a slight survival advantage over (*b*) on burned seedbeds in the greenhouse, but the difference was neither consistent nor large enough to suggest the use of controlled burning to favour Spruce over Fir.

3948. **Seedbed preparation for natural regeneration of Western Larch.** *Rep. Intermt. For. Range Exp. Sta. 1954*, 1955 (13–4).

The following treatments were used in an area where seed trees had been left after commercial felling in a mixed stand of Larch, Douglas Fir and Engelmann Spruce: (1) control, no treatment; (2) mechanical scarification; (3) prescribed burning; (4) understorey cut, piled and burned. All species were favoured by (2) and (3) but Larch benefited more than the other species and gained a more favourable position than its competitors.

3949. **Disking increases Yellow Birch reproduction.** *Rep. Lake St. For. Exp. Sta. 1954*, [1955] (8).

In an experiment installed in 1952, a 20-acre tract of Hemlock/hardwood was cut to leave a residual stand per acre of 3000 bd. ft. gross of *Betula lutea*, properly spaced for seed dispersal, and the ground was disked to expose 4 different proportions of mineral soil. The number of 0- to 6-in.-tall Yellow Birch seedlings was greatly increased by all degrees of disking. The larger sizes showed varying response to disking intensity. Distribution of reproduction was good. Unless mortality is heavy in succeeding years, it appears that disking to expose mineral soil on 25% of the seedbed will give good stocking.

3950. LORNE, R. Propos sur la régéneration du chêne dans l'ouest. **[The regeneration of Oak in western France.]** *Rev. for. franç.* 7 (6), 1955 (476–87 + 2 photos). [F.]

Emphasizes the need for thinning, cleaning etc., in natural reproduction of Oak, which is commonly neglected by French foresters.

232. *Artificial Regeneration*

See also Nos. 3851, 4110, 4817, 4823.

3951. BLYTH, A. W. **Seeding and planting of Spruce on cut-over lands of the subalpine region of Alberta.** *Tech. Note For. Br. Can.* No. 2, 1955. pp. 11. 4 refs.

An experiment was started in spring 1947 to determine suitable means for securing White Spruce regeneration on logged and non-burned lands (cut-over lands) in the sub-alpine region of Alberta. In all, 60 combinations of treatments were tested, on 8 blocks, distributed in four localities. Each block contained 5 sub-blocks within which the treatments were randomized and applied to milacre units. The following conclusions were drawn from the experiment following a final examination made in autumn 1951: (1) Planting was the most successful method of regeneration, with 55 to 80% survival 5 years after planting. For broadcast and spot sowing, the average degrees of success for all conditions were 25 and 21% respectively. Natural seeding was a failure, averaging only 2% success. (2) Ground treatment had no effect upon the sucess of planting, but for regeneration by sowing, produced superior results. Removal of litter and/or sod combined with cultivation of an area 4 ft. in diameter was the most effective treatment. Natural regeneration was unsatisfactory on all ground treatments. (3) Seed stratification resulted in earlier germination but had no significant effect upon final survival. (4) Protection of seed from rodents was essential. Wire mesh cages were effective and appeared also to improve the ecoclimate on the caged spot. A small wooden seed-protecting device was unsatisfactory. (5) Success from sowing varied greatly with site (between blocks). Heavy ground vegetation, especially grass, had an adverse effect. *From author's summary.*

3952. STEIN, W. I. **Some lessons in artificial regeneration from southwestern Oregon.** *Repr.* from *Northw. Sci.* 29 (1), 1955 (10–22). 9 refs.

Discusses the results of studies in S.W. Oregon. Artificial regeneration of Douglas Fir was not fully satisfactory by any method, planting on national forests giving 50% average survival. Sowing in unscreened spots proved promising for regenerating Sugar and Ponderosa Pines, using poisons or repellents for rodent control. By placing seed spots more densely than trees are planted, stocking comparable to planting has been obtained at less cost. Planting gave consistently better results on pumice soils. Autumn is recommended for direct sowing. K screens [see *For. Abstr.* 15 (No. 3519)] gave good results, but can be of only limited use until machine methods of making, filling and installing them have been developed. Regeneration should be carried out as soon as possible after logging and burning, when rodents, cutworms and competing vegetation are at a minimum.

3953. HAMILTON, J. R. **Planting Black Locust [*Robinia pseudoacacia*] for fence posts [in Georgia].** *Circular, Georgia Experiment Station, Experiment, Ga.* No. 170, 1953. pp. 11. 3 refs.

232.1. Choice and Trial of Species, Races etc.

See also Nos. 3744, 3978–9.

3954. SCHMIDT, W., and STERN, K. Methodik und Ergebnis eines Wachstumsvergleichs an vier zwanzigjährigen Kiefernversuchsflächen. **[Methods and results of a comparison of growth in four 20-year-old Pine trial plots.]** *Z. Forstgenet.* 4 (2), 1955 (38–58). Many refs. [G.g.e.f.]

K. Stern's method [see *For. Abstr.* 16 (No. 1599)] was tested on 20-year-old *Pinus* spp. The growth-quotient curve gives a measure of the relative shapes of development of variety *a* as a % of that of variety *b*. The rhythm of growth is already shown by the course of the curve in the first 20 years, but it is not possible to forecast the correlation between growth in youth and in old age from a momentary assessment of the absolute growth rates. The material studied showed distinct difference in rhythm between provenances from cold climates and from warm climates. Individual variants differing from the rhythm of the provenance were detected. The rhythm of the varieties may possibly not be maintained on different sites. Unfavourable reactions to a site departing considerably from the requirements of a provenance are clearly detected with the method used here. Failure on only one such site does not, however, justify the rejection of the variety; tests should be made on several sites varying in climate and soil. In future, provenance and single-tree-progeny tests must be strictly separated, according to the requirements of statistical evaluation. Tests for early growth and for permanent series of observations must also be separated, depending on the aim of the experiments. The course of the curve of development is changed only temporarily by variations in weather from year to year. Even after several years of disturbances the curves follow the primary tendency of the variety after the reaction has faded away. *From authors' summary.*

3955. Naets, M. Le pin laricio de Corse en Campine. **[Corsican Pine in the Campine.]** *Bull. Soc. for. Belg.* 62 (4), 1955 (206–10 + 1 photo). [F.]

A general note on the value of this species as a substitute for Scots Pine on the dry, sandy soils of this region.

3956. Oliveira, M. de. Aspectos da introdução de algumas Pináceas no estado de São Paulo. **[The introduction of some Pinaceae into the State of São Paulo.]** *Ediç. Prop. Serv. flor. Est. S. Paulo* No. 39, 1953. pp. 15. 10 refs. [Port.]

Notes on the silvicultural characters of *Pinus radiata* and the 'Southern' Pines, and their suitability for afforestation in São Paulo.

3957. **Permanent plantations: (1) development of evergreen species; (2) development of species in shelterbelts.** *Progr. Rep. Dom. For. Nursery Sta. Sask. 1947–52*, 1954 (10–6).

Gives tabulated data on the development of: (1) evergreen species, (2) species in shelterbelts, (3) trees planted (*a*) east and (*b*) west of established trees, and (4) species as influenced by soil alkalinity, all in plantations at or near Indian Head, Saskatchewan, established from 1904 to 1913.

It has become clear that evergreen species (some introduced) are superior to broadleaved species in almost every respect (relative hardiness, rate of growth, longevity, protective value, and year-long attractiveness). White Spruce [*Picea glauca*] appears to be the most desirable species to use for underplanting whether of broadleaved or coniferous species. *Caragana arborescens* near to other species has usually restricted their development, but the pendulous type of *Caragana*, planted in alternate rows, apparently exerts a beneficial effect on trees in adjacent rows.

Several species appear to do better when planted east than when planted west of established trees, an exception being Ash. A test of survival and growth of several species on highly alkaline soil was begun in 1945. The species tested were (1) *Shepherdea argentea*, (2) *Sorbus americana*, (3) *Elaeagnus angustifolia*, (4) *Halimodendron halodendron*, (5) *Hippophaë rhamnoides*, (6) *Ulmus pumila* and (7) *Syringa villosa*. Best survival was obtained with (1), (3), (4) and (5); of these (1) and (3) are most suitable where a taller hedge or windbreak is desired, and (4) and (5) for a hedge of medium height.

3958. Wilner, J., and Morgan, G. A. **Study of factors affecting growth and development of mature tree species commonly grown on the prairies.** *Progr. Rep. Dom. For. Nursery Sta. Sask. 1947–52*, 1954 (37–40).

The factors studied were: (1) effect of spacing and mulching on drought resistance and maturity [cf. *For. Abstr.* 14 (No. 2006)]; and (2) factors affecting winter injury of certain woody plants. [Cf. *For. Abstr.* 14 (No. 3150).]

232.11. *Species Trials (by Localities), including Forest Gardens, Trials of Exotics etc.*

See also Nos. 3927, 4828.

3959. Wood, R. F., and Thomson, J. H. ***Cupressus macrocarpa* plantations at Cumlodden, Argyll.** *Quart. J. For.* 49 (2), 1955 (126–8 + 1 photo). 2 refs.

Compares increment of these plantations (one pure and one mixed) with that of one in Sussex [cf. *For. Abstr.* 15 (No. 3429)]. The Cypress seems to thrive as well on the acid Argyll soil as on the Sussex chalk.

3960. Moffart, A. de. Contribution à l'étude de *Abies lowiana* en Belgique. **[A note on *A. lowiana* in Belgium.]** *Bull. Soc. for. Belg.* 62 (4), 1955 (210–1). [F.]

The author urges the introduction of this species on an economic scale. It has proved highly resistant to wind, decay, snow breakage and insects, and exceeds both Douglas Fir and *Abies grandis* in rapidity of growth.

3961. Hartman, L. A. ***Pinus insignis* [*P. radiata*] plantations in Chile as basis for industrial development.** *Pap. ja Puu* 37 (4*a*), 1955 (140 . . . 149). [E.fi.] P.R.

Discusses the properties and uses of the wood, plantations in Chile, and actual and potential output and consumption.

3962. Iljičev, D. A., and Fedorako, B. I. Vyraščivanie topolja v Baškirii. **[Cultivation of Poplar in Bashkiria].** *Lesn. Hoz.* 5 (9), 1952 (58–60). [Russ.]

The heavy accumulation of snow, and hence of soil moisture, under shelterbelts in Bashkiria, creates conditions favourable to the introduction of Poplars. Among these, the best growth has been shown by *Populus balsamifera* (mean height 10·7 m., diam. 14·7 cm. at 11 years), *P. simonii* (11·0 m., and 8·4 cm. at 13 years), *P. laurifolia* (9·6 m. and 6·7 cm. at 11 years), and a hybrid raised by A. M. Berezin which at 16 years had a mean height of 16·5 m., a diam. of 21·9 cm., m.a.i. 39·4 cu.m. and a standing volume of 630 cu.m./ha., which is 6·3 times as high as that of Aspen of the same age. The growth of 'Canadian' Poplar, however, has been very poor, with badly shaped stem, and this Poplar has proved sensitive to frost. Growth of Poplars is good both on low-lying sites and on watershed plateaux, provided that moisture is adequate and the soil deep and rich in humus. Under the drought conditions of southern Bashkiria, and on dry eroded slopes, their growth is poor, they branch heavily, become stagheaded and usually die. The present plantations have been raised from ordinary cuttings and from buried 'setts' (1- to 4-year-old shoots). Setts are cut in March or early April and stored in snow or on ice. In April, all the lateral branches are cut off and the setts placed in a line, top to butt, at the bottom of a freshly made furrow 16–20 cm. deep, which is filled with earth at the next passage of the plough; the earth is then firmed by roller or trampling. Figures are tabulated to illustrate the development of 1- to 4-year setts of *P. balsamifera*, planted by the above method, during the 1st and 2nd season after planting, compared with that of ordinary cuttings. Setts thus buried in furrows in April 1950 produced by June 6·3 young shoots per running metre of furrow, most of the shoots reaching 32 to 36 cm. in height. The planting of setts is 2–3 times as quick and cheap as the planting of cuttings. It is

especially suited for drought conditions where ordinary unrooted cuttings suffer high mortality.

3963. Boudy, P. L'*Eucalyptus*. **[The genus *Eucalyptus*.]** *Chêne-Liége* No. 1501, 1954 (23–7); Nos. 1502–1512, 1955 (21–5; 19–27; 13–9; 29–33; 25–9; 17–9; 27–31; 15–9; 15–9; 11–3; 19–21). [F.]

A general description of the genus, with notes on a number of species tested, or considered worth testing, in N. Africa.

3964. Groupe de travail des *Eucalyptus* (première session, Maroc, 22–31 Octobre 1954). Compte rendu de la session et du voyage d'étude. **[*Eucalyptus* study group (1st Session, Morocco, 22–31 Oct. 1954). Proceedings of the session and the study tour.]** Station de Recherches forestières, Rabat. 1954. pp. 202 + 11 photos + 1 map. [F.]

In addition to the formal proceedings, includes the following: (1) Technical report on identification of Eucalypts found in Morocco. (2) Technical report on silviculture. (3) *Eucalyptus* plantations in southern Italy and the Islands (*V. Bassi*) [cf. *For. Abstr.* 16 (No. 2866)]. (4) Determination of moisture content, oven-dry density and dry-weight/green volume ratio for 3 trees of *E. botryoides* aged 14 years (*P. Curro* and *G. Giordano*). (5) The *Eucalyptus* and Tripolitania (*G. Giaddaui*, in English). (6) Research completed and in progress on *Eucalyptus* in Portugal (*E. da S. Reis Goes*) [cf. *For. Abstr.* 16 (No. 1477)]. (7) Monograph on *Eucalyptus* in Portugal (*E. da S. Reis Goes*) [cf. *For. Abstr.* 16 (No. 1478)]. (8) Inventory of *Eucalyptus* spp. in Portugal (*E. da S. Reis Goes*) [cf. *For. Abstr.* 16 No. 1479)]. (9) *Eucalyptus* in Tunisia (*G. Lacourly*). (10) Key to the principal species of *Eucalyptus* cultivated in Morocco (*A. Métro*). (11) A hybrid of *E. robusta* (*A. Métro*) [note on a natural hybrid occurring in a pure plantation of *E. robusta*]. (12) Results obtained in the *Eucalyptus* arboreta of Morocco (*A. Métro*). (13) The use of 'rooters' in afforestation work in Algeria (*A. Monjauze*). [Describes the use of American rooters for preparing areas of maquis, steppe soils etc., for planting Eucalypts in Algeria]. (14) Report on French Eucalypt working party (*J. Pourtet* and *P. Turpin*) [cf. *For. Abstr.* 16 (No. 1476)]. (15) Eucalypt plantations in French Morocco (*P. Vidal*). The appendices include a bibliography (42 references).

3965. Bassi, V. Viaggio di studio sugli eucalipti al Marocco. **[Study tour on Eucalypts in Morocco.]** *Monti e Boschi.* 6 (4), 1955 (157–66). [It.f.e.]

See preceding abstract.

3966. Mattos, H. Peres de. Estudos da ocorrência dos eucaliptos na Australia. **[The occurrence of Eucalypts in Australia.]** *Arq. Serv. flor., Brasil* 7, 1953 (71–149). 9 refs. [Port.e.]

Report on the FAO Eucalyptus study tour in Australia [cf. *For. Abstr.* 15 (Nos. 3334–5)], species, silviculture and possibilities for Brazil, with information on wood properties and uses.

3967. Thirawat, S. **The Eucalypts for tropical climates: based on experiences gained from the FAO *Eucalyptus* study tour in Australia, 1952.** *Indian For.* 81 (4), 1955 (224–47).

The author summarizes a longer, unpublished, report, comprising (1) general considerations, (2) determination of species suitable for the tropics, (3) detailed notes on species suitable for planting and experiment in Thailand, meteorological data of Thailand, and notes on species that have been tried in India.

3968. Le reboisement en Nouvelle-Calédonie. **[Afforestation in New Caledonia.]** *Rev. int. Bois* 22 (204), 1955 (99, 101). [F.]

A note on Eucalypts tested in New Caledonia. The following species are recommended: *E. grandis*, *E. microcorys*, *E. pilularis* and *E. paniculata*.

232.12. *Races and Provenance Trials*

See also Nos. 3954, 4404.

3969. Schmidt, H. Kartierung bodenständiger Bestände. **[The mapping of native stands.]** *Z. Forstgenet.* 3 (6), 1954 (118–22). 4 refs. [G.g.e.f.]

Discusses some problems inherent in distinguishing and mapping foreign races present in German stands. In Selb, a forest district of Bavaria, phenotypic characteristics were used in distinguishing races of *Pinus*. This, however, is not always possible, particularly for the deciduous species and for *Abies alba*, and in such cases the only possible method is a study of the history of stands from documents and archives. *From author's summary.*

3970. Tusko, F. Adatok a szárazságtürö fenyöfajták kiválasztásához. **[The choice of drought-resistant conifer [Pine] strains.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (108–12). [Hu.russ.e.g.]

Seeds of Scots and Austrian Pine of several Hungarian provenances were sown in 3 nurseries, Bugac (clay soil, irrigated), Budakesci (calcareous sand, not irrigated) and Nyirség (non-calcareous sand, not irrigated) and the resulting stock compared. Preliminary results are given, and also for *P. pinaster* and *P. ponderosa*.

3971. Noskov, V. I. Značenie sbora semjan sosny po tipam lesa. **[The importance of collecting Scots Pine seed with due regard to forest types.]** *Lesn. Hoz.* 5 (8), 1952 (54–6). [Russ.]

Pine seed collected in the following forest types of the Altai region: (1) dry steppe-margin Pine, (2) other dry Pine, (3) *Pineta hylocomiosa*, (4) *Pineta herbosa*, and (5) Pine forests of wet depressions, was sown in 1941 in nursery conditions of forest type (1). Best plant % and continued survival were obtained with seed from types (1) and (3). Examination in 1951 of plots established within the zone of type (1) into which, in spring 1945, 4-year seedlings had been transplanted, showed that those raised from seed of the dry-forest types surpassed, in height increment after their 7th year, those raised from seed collected in moist types (4) and (5). In general, the root systems of the progeny resembled those of the parent stands.

3972. McGregor, W. H. D., Cowan, D. R., and Spurr, S. H. **Three races of Scotch Pine compared in southeastern Michigan.** *Mich. For.* No. 5, 1954. pp. 2. 1 ref.

Results of a provenance trial of *Pinus sylvestris* from (1) Bavaria, (2) Norway, and (3) Riga indicate

that (1) grows fast but is of poor form, (3) is of good form but grows slowly, and (2) is of better form than (1), grows faster than (3), and is the most promising.

232.13. *Trials of Hybrids and other Products of Tree Breeding*

See also section 165.

3973. Baldwin, H. I., and Funking, D. L. **Twenty years' growth of hybrid Poplars.** *Fox For. Note* No. 56, 1954. pp. 2.

A further report on Stout and Schreiner hybrids, planted in 1935 as unrooted cuttings. The first 6 years' growth was reported in an earlier note [cf. *For. Abstr.* 3 (p. 86)]. Growth was in the following descending order of clones: Geneva, Oxford, Androscoggin, Rochester, Strathglass.

232.2. Preparatory Work, Auxiliary Measures

See also Nos. 3930, 3951, 3964, 4070–2, 4851.

3974. Noguchi, Y. **[Experiment of Sasa cutting by Brushmaster.]** *Misc. Inform. Tokyo Univ. For.* No. 10, 1955 (77–82). [Jap.e.]

Sasa paniculata was cleared by a 2-man crew at the rate of 6·3 days/ha., twice as fast as hand labour. Savings in man power were 64% and in cost 29%.

3975. Volovodov, S. G. Vlijanie glubiny vspaški na razvitie duba v uslovijah temnokaštanovyh počv Prisivašja. **[Influence of depth of ploughing on the development of Oak on dark-chestnut soils in the Lake Sivash region.]** *Počvoved.* 1954 (11), (66–70). [Russ.] A.P.B.

Studies made in the Genichesk district, Kherson region, Ukraine, of soil moisture and the root and shoot development and survival during the first year, of nest-sown or planted *Quercus robur*, showed that shallow ploughing (28–30 cm.) gives poor results, deep ploughing (60 to 70 cm. or more) being necessary for satisfactory establishment on these droughty soils.

3976. Ščerbinin, N. M. Glubokoe ryhlenie bez oborota plasta—priem obrabotki počv pod lesnye porody. **[Deep loosening without turning the furrow slice—a method of soil cultivation for forest planting.]** *Lesn. Hoz.* 5 (9), 1952 (9–13). [Russ.]

Stresses the importance, for the successful establishment of plantations on brown and grey desert-steppe soils, of loosening the compact horizon formed in the course of the normal development of steppe soils. This horizon, which starts at 14–30 cm. and extends down to 35–53 cm. from the surface, is best broken up *in situ* with a heavy ripper cultivator. Drawn by a tractor, this implement can work 1·25 ha. per hour. Tabulated data for density of soil sample (g./c.c.), total, capillary, and non-capillary porosity (in % by volume), field moisture content (in % by volume), and hygroscopic moisture, illustrate the improvement of moisture conditions effected by loosening this horizon. Other figures show improvement in rate of growth and survival of *Ulmus parvifolia* and *Caragana arborescens* on ripped soils compared with soils having an undisturbed compact horizon. The effect of ripping is of long duration. A table gives the moisture characteristics of ripped soil at 5 depths during two consecutive seasons.

3977. Rubanov, B. V. Glubokoe borozdovanie v zone suhih stepeĭ i polupustyni. **[Deep furrowing in the dry steppe and semidesert region.]** *Lesn. Hoz.* 5 (9), 1952 (13–4). [Russ.]

The best method for accumulating and conserving soil moisture for tree plantations on the brown desert-steppe soils of Astrakhan Province consists in (1) ploughing to a depth of 27–30 cm., (2) deepening the cultivated layer down to 35–40 cm. with a subsoiler, and (3) deep furrowing of planting and sowing sites. Special importance is attached to the latter work, as it not only assists soil aeration but also allows atmospheric and surface moisture easy access to the bottom of the furrows and helps percolation. It also reduces the amount of energy needed by Oak roots to penetrate 60–70 cm. deep into the soil, thus conserving more energy for shoot growth. Cultivation of the site should be started late in September of the year preceding planting, using for (3) a special plough with its mouldboard removed.

232.3. Seed, Nursery Practice, Direct Sowing

3978. Goor, A. Y. **Tree planting practices for arid areas.** *FAO For. Developm. Pap.* No. 6, 1955. pp. vi + 126 + 1 photo. 98 refs. Price $1·50 (7*s.* 6*d.*).

Contains chapters on the following: collection and handling of seed; forest tree nurseries; plant production in nurseries; afforestation (site preparation, choice of species, planting, direct sowing, care of plantations, costs, special plantations). There are three appendices: (1) notes on species used in afforestation in the Near East; (2) summary of seed collection and handling practices; (3) summary of nursery operations.

232.31. *Seed*

See also Nos. 3890–1, 3898–3900, 4110.

3979. Magini, E.; Tulstrup, N. P. **Tree seed notes: Part 1. Forest tree species suggested for trial under arid and semi-arid conditions in tropics and subtropics, including high altitudes. Part 2. Forest tree species suggested for trial under humid conditions in the tropics and subtropics.** *FAO For. Developm. Pap.* No. 5, 1955. pp. 354.

Gives notes on 89 species in Part 1, and 95 species in Part 2, under the heads: chief use, natural range, soil and climate, natural races, seeding age, collection, number of seeds per unit, germination, extraction and storage, treatment prior to sowing, and general remarks.

3980. Baldwin, H. I.; Holmes, G. D. **Handling forest tree seed.** *FAO For. Developm. Pap.* No. 4, 1955. pp. viii + 110. 131 refs. Price $1·0 (5*s.*).

Part 1 (Methods of handling forest tree seed, from procurement to packaging) covers collection, extraction and cleaning, storage, packaging, testing, and control of insects and fungi. Part 2 (International rules for testing seed of forest tree species) summarizes the rules on sampling; purity analysis;

germination testing; determination of disease organisms, insects etc.; determination of genuineness of type, variety and strain; international seed analysis certificate; determination of moisture content; weight determinations; tolerances, method of making the homogeneity test.

232.311. Seed Production (Seed Years, Seed Crops; Seed Orchards and Methods of Inducing Seed Production)

See also Nos. 3803 *et seq.*, 4404, 4851.

3981. Dostál, L'. Borievka obyčajná. [***Juniperus communis***.] *Les, Bratislava* 2 (4), 1955 (168–70). [Slovak.]

Tabulates the results of investigations on the number of seeds in berries of *J. communis* (in Slovakia), collected late in June, 1954, from 3 trees ca. 2 m. high, growing at an altitude of 120–130 m. In all, 800 berries were examined. The number of healthy seeds per berry increases with the size of the berry and with its lowness on the tree; it is also greater for berries on the shaded side of the tree.

3982. **Effect upon seed production of size of Larch seed trees.** *Rep. Intermt. For. Range Exp. Sta. 1954*, 1955 (12–3).

The seed catch over 4 years from seed trees averaging 14, 18 and 22 in. d.b.h. increased with d.b.h. Seed production from trees $< 12{\cdot}5$ in. d.b.h. was negligible. No trees > 22 in. d.b.h. were included but, as such trees are generally decadent and have small crowns, seed production would probably level off or decrease.

3983. Ruth, R. H., and Berntsen, C. M. **A 4-year record of Sitka Spruce and Western Hemlock seed fall on the Cascade Head Experimental Forest.** *Res. Pap. Pacif. Nthwest. For. Range Exp. Sta.* No. 12, 1955. pp. 13. 5 refs.

Six clear-felled areas, ranging from 15 to 81 acres, received adequate seed from surrounding stands throughout their area. Seed fall started with the first drying winds in the last 10 days of October and tapered off gradually until April and May. *Tsuga heterophylla* produced more seed than *Picea sitchensis*. Seed fall under dense 100-year Spruce/Hemlock stands was 15 times that on clear-cut areas. Viability of seed from the 2 species averaged 55%.

3984. Carvell, K. L., and Korstian, C. F. **Production and dissemination of Yellow-Poplar [*Liriodendron tulipifera*] seed.** *J. For.* 53 (3), 1955 (169–70).

From 3 years' sampling on 25 acres, it is concluded that abundant seed is produced almost every year. Seed falls from mid October to late March with the peak early in November. The viability of 11·1% is maintained through the winter. Fruit clusters average 81 seeds. A production of 300,000 seeds/acre is not uncommon, but excess raw humus, poor soil aeration and severe competition by woody species reduce regeneration, which is best in openings where the soil is exposed. In good conditions, 8–10 seed trees/acre, 14–20 in. d.b.h., are enough to re-seed a cut-over area. A straight-line relation is established between d.b.h. and number of fruit clusters per tree.

3985. Matsui, Z., Moori, K., and Shinohara, H. **[The production of Mizunara-Oak seeds in a good fruiting year.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (162–7). 4 refs. [Jap.jap.e.]

In a good year like 1942, acorn production by *Quercus crispula* in Kushiro roughly equalled the yield of wheat, at 2124 kg./ha. A good crop occurs once in 3–10 years and an ordinary year produces ca. 17% of this. The scatter of acorns is represented by $y = 222\ [\sin 90 - \frac{90}{12}x]^2$ where $y =$ number of acorns and $x =$ distance in m. from the mother tree. Few acorns germinate. They are taken partly by cattle but mostly by rats, the population of which is thereby greatly increased with consequent damage to Larch plantations. The acorns should be milled for cattle food.

3986. Christisen, D. M. **Yield of seed by Oaks in the Missouri Ozarks.** *J. For.* 53 (6), 1955 (439–41). 13 refs.

Tables show the production of mature acorns/tree over 6 years for *Quercus alba*, *Q. coccinea*, *Q. marilandica*, *Q. stellata* and *Q. velutina*; the % of immature acorns; the % of acorns sound, insect-damaged, and used by wild-life; the mean and best-year numbers of sound acorns/tree and the mean number of sound acorns/lb.

3987. Jensen, H. **The establishment of forest tree seed orchards at Ramlösa 1941–1954.** *Meddelanden från Göteborgs Botaniska Trädgård* (*Acta Horti Gothoburgensis*), *Göteborg* 19 (5), 1954 (157–92). 14 refs. [E.] Price *Kr.*4.

3988. Hitt, R. G. **A progress report on methods for stimulating flowering at an early age on Red Pine, *Pinus resinosa*.** *For. Res. Note Univ. Wis.* No. 18, 1954. pp. 2.

Experiments are in progress with: (1) wire strangulation, (2) double semi-circular girdling, (3) spiral girdling, to induce flowering in 25- to 30-year-old Red Pine. Treatments (2) and (3) gave increased production of both ♂ and ♀ flowers, but the production of ♂ flowers declined in the 4th season. In younger (15-year-old) trees, treatment (1) is apt to cause death. On all ages, treatment (3) produced the largest average number of flowers of both sexes, but in many cases caused die-back of terminal parts of the crown.

3989. Schaffalitzky de Muckadell, M. **A development stage in *Fagus silvatica* characterized by abundant flowering.** *Physiol. Plant., Copenhagen* 8 (2), 1955 (370–3). 2 refs. [E.]

Scions of *F. sylvatica* with many flower buds were kept in a flowering development stage by grafting on to horizontal branches on the S.W. side of a 50-year-old isolated tree. Similar material grafted on to young rootstocks were soon transformed into a vegetative state.

232.312. Seed Collection, Extraction and Grading (including Seed Weight)

3990. **Collection and storage of Ash [*Fraxinus excelsior*], Sycamore [*Acer pseudoplatanus*] and Maple [*A. campestre* and *A. platanoides*] seed.** *Leafl. For. Comm., Lond.* No. 33, 1955. pp. 9. Price 6*d.*

3991. Kaláb, J. Mechanizácia zberu lesných semien. **[Mechanization of forest seed collection.]** *Lŝs, Bratislava* 2 (1/2), 1955 (20–3). [Slovak.]

Describes the design and operation of a 'vacuum-cleaner' seed-collecting appliance used for collecting acorns, Beech mast, and seed of Lime, Hornbeam, etc. The main part of the appliance is a turbo-compressor of the aircraft [?] type, driven by the universal PF-6 'motorobot' which is the source of mechanical power for forest and nursery work in Czechoslovakia. The whole appliance is mounted with the 'motorobot' on a frame.

3992. Vaz, A. L. Castelão. A importancia da origem na semente florestal; alguns dos factores que afectam a qualidade da semente na *Cupressus lusitanica* Miller. **[The importance of provenance in forest seed; some factors affecting the quality of seed of *C. lusitanica*.]** *Estud. Inform. Serv. flor. aqüic. Portugal* No. 45–C3, 1955. pp. 33. 13 refs. [Port. port.] Limited distribution.

Discusses the suitability of *C. lusitanica* for afforestation in Portugal and the importance of choosing seed of good provenance, and presents the results of investigations into some important factors affecting its seed quality: (1) Influence of climate: the tests gave no conclusive data. (2) Age of parent tree: also inconclusive; there may be some correlation but the issue is complicated by genetic factors. (3) Position on tree, i.e. north or south: no correlation was found. (4) Size of fruit and weight of seed: on a given individual, seed from bigger cones is generally of higher quality. (5) Maturity of seed: it is not necessary to await complete maturity of the cones before collecting.

3993. Koren, R., and Potočnik, M. Luščenje macesnovih storžev. **[Extraction of seed from Larch cones.]** *Gozd. Vestn.* 13 (1/2), 1955 (39). [Sloven.]

Larch cones were placed in a 10-cm. layer on a flat, sheet-metal roof in April. After 4 days of intermittent sunshine, rain, and night fog the cones were turned; seed shedding began on the 8th day and ended a week later. All cones were wide open, and the quality of seed was excellent.

232.315. Seed Storage and Treatment

See also Nos. 3951, 3990, 4013, 4036–7.

3994. Garrard, A. **The germination and longevity of seeds in an equatorial climate.** *Gdns. Bull.* 14 (2), 1955 (534–45). 7 refs. [Department of Botany, University of Malaya.]

The % germination of 28 species of locally grown plants was determined immediately after collection and after storage at monthly intervals up to 10 months. The high humidity and relatively high temperature conditions were unfavourable for seed storage. Only 6 species had seed that remained viable until the end of the 10-month period. There was rapid degeneration in small seed and seed of trees of Malayan origin. The seeds of *Daniella ensifolia* and *Asclepias curassavica* were not fully mature when collected, and required a period of after-ripening. The permeability of the seeds of *Adenanthera pavonina* and *Urena lobata* decreased under storage in air but the viability of the seed did not decrease, since there was no change in the germination % of scarified seed. When seeds of *A. pavonina* are placed in a germinator they do not all germinate immediately but may require a period exceeding a year before they have all germinated; scarified seeds all germinate within 4 days. The damp conditions render the testa more permeable in unscarified seed but the time before this occurs varies from seed to seed. *From author's summary.*

3995. Filho, O. do A. Gurgel. Compreensão da ocorrência de 'hard seed' e de dormência nas sementes e métodes para auxiliar a germinação. **[The occurrence of 'hard seed' and dormancy in seed and methods of stimulating germination.]** *Ediç. Prop. Serv. flor. Est. S. Paulo* No. 52, 1954. pp. 13 + 5 tbls. 13 refs. [Port.]

3996. Cram, W. H. **Caragana seed maturity and germination.** *Progr. Rep. Dom. For. Nursery Sta. Sask. 1954*, [1955] (82–4).

Dormancy of *Caragana arborescens* seed increases and moisture content at time of harvest decreases, as date of maturity approaches. Germination capacity of non-stratified seed decreased from 82 to 57%, and germination rate (index) from 0·46 to 0·23, as seed moisture content decreased from 72 to 44% for 4 successive dates of harvest over a 20-day period. Germination capacity and rate increased materially, however, when m.c. of the seed at harvest fell below 40% just before natural dehiscence of the pods. Stratification for 15 days at 41° F. induced an increase of $> 20\%$ in germination of all seed having m.c. $< 70\%$ at time of harvest or harvested 1–17 days before natural dehiscence. Dormancy was evidently much greater for seed harvested 24 days before dehiscence and having a m.c. $> 70\%$.

There was no significant difference in average germination capacity or rate for 1- and 2-year-old seed, but germination was consistently higher for the smaller (2·5–3·0 mm. diam.) than for the larger 2-year-old seed, and vice versa for the 1-year-old.

3997. Soster, P. Come si favorisce la germinazione di alcuni semi forestali. **[Measures to improve or hasten germination of some forest tree seeds.]** *Monti e Boschi* 6 (4; 5), 1955 (177–85; 217–23 + tbl.). [It.f.e.]

Discusses the effect of stratification and other methods in stimulating germination of *Celtis australis*, *Carpinus betulus*, *Acer negundo*, *A. pseudoplatanus*, *A. platanoides*, *A. campestre*, *Ostrya carpinifolia*, *Fraxinus ornus* and *Tilia cordata*.

3998. Pryor, L. D. **Improved germination of some alpine Eucalypts by stratification.** *Aust. For.* 18 (2), 1954 (104–6). 1 ref.

Cold and moist treatment of seed of *E. gigantea*, *E. niphophila*, and a mountain form of *E. pauciflora* is found to improve greatly the amount of germination, which in these species is often very low or even nil without treatment. Similar treatment hastens the germination of *E. dives* and the effect is more prominent with *E. dives* from 4000 ft. elevation than from 2000 ft. *Author's summary.*

232.318. Seed Testing. Germination Tests. Seed Quality

3999. MATYÁS, V. A hazai térmesü erdei-és feketefenyö mag minöségi osztályozása az 1949–1951 évi magvizsgálatok alapján. **[Evaluation of seed of Scots and Austrian Pine grown in Hungary, according to 1949–51 tests.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (91–107). [Hu.russ.e.g.]

Detailed report on tests carried out and standards arrived at by the seed-testing laboratory of the Hungarian Institute of Forest Sciences, in the light of the emphasis put, in the general afforestation plan for the country, on extending the area of these two species.

4000. EVRARD, R. Contribution à l'étude des propriétés germinatives de faînes par la méthode au chlorure de 2-3-5-triphenyltetrazolium. **[Study of the germinative properties of Beech seed by the 2, 3, 5-triphenyl-tetrazolium-chloride method.]** *Bull. Inst. agron. Gembloux* 23 (1), 1955 (49–54). 6 refs. [F.] E.M.B.

Beech mast was collected in 3 districts in the forest of Haute Marlagne and tested by this method in comparison with seed from the Forêt de Soignes and with certified seed from Germany. Except in the German provenance, the test revealed relatively low viabilities, i.e. few embryos and cotyledons completely coloured. In most cases the cotyledons reacted poorly to the test chemical, indicating that the germinated seed would have had a poor chance of developing beyond the cotyledonary stage. This observation is confirmed by the past history of regeneration in the Haute Marlagne Forest. The usefulness of such tests in planning silvicultural treatment is pointed out.

232.32. *Plant Rearing. Nursery Practice*

See also Nos. 3978, 4099, 4110, 4823.

4001. Viveros forestales. **[Forest nurseries.]** *Agric. venez.* 19 (170), 1954 (6–9, 39). [Span.] A.P.B.

Recommendations for nursery practice in Venezuela with illustrative costs of some operations in the Ministry of Agriculture's forest nurseries.

232.321. Nursery Sites, including Factors affecting Selection of Sites for Nurseries

See also No. 3946.

4002. MACDONALD, J. **The heathland nursery.** *Irish For.* 11 (2), 1955 (41–7).

Describes the techniques first developed by Dr. Rayner at Wareham, under the heads: choice of site; preparation of site; manuring; preparation of seed-beds; sowing; top-dressing; lining-out; size of seedling produced; management; all based on Forestry Commission experience in Great Britain.

4003. OTA, I., and MOTOKI, S. **[Meteorological investigation in the nursery. (No. 1.)]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 76, 1954 (149–67). [Jap.jap.e.]

Gives details of short-period observations of soil and air temperatures at − 5, 0 and + 30 cm. in bare ground, nursery and plantation, and of evaporation at 30 cm., illustrated in maps showing lines of equal value for these factors. The vertical distribution at 0, 5, 10 and 15 m., of air temperature, humidity, vapour pressure and wind velocity by 2-hour intervals over 2 days is shown on graphs. The effect of neighbouring forest on nursery climate is discussed.

232.322. Preparation and Treatment of Soil, including Maintenance of Fertility.

See also Nos. 3781–2, 4012, 4641–3.

4004. WILNER, J., and MORGAN, G. A. **Study of factors affecting production of nursery stock [in Saskatchewan].** *Progr. Rep. Dom. For. Nursery Sta. 1947–52*, 1954 (36–7).

Summarizes the results of research on: (1) *Effect of certain rotations and intercropping.* Results indicated a generally beneficial effect of *Caragana* on succeeding crops of Boxelder [*Acer negundo*], Ash and Elm, but no such result from intercropping with wheat grass, oats, or summer fallow. The shoot/root ratio for *Caragana* was consistently higher than that for Boxelder, Ash, and Elm, possibly owing to additional N made available by its bacterial root nodules. It is suggested that shoot/root ratio may be a better criterion of climatic or soil variation than seedling vigour expressed as fresh weight. (2) *Study of methods of ameliorating conditions of seedlings grown on certain unproductive soils.* The soils concerned had excessive amounts of salts (e.g. nitrates 50 times greater than normal, Mg 15 times, Ca 10 times, Na 5 times), and the appearance of roots suggested that root injury, possibly due to excess of soluble salts, was the primary reason for the general decline of seedlings. Various methods of correcting these unfavourable soil conditions were tried—fertilization, manuring, raising crops of sweet clover and oats, crested wheat grass, application of Fe and P, scarification, ploughing and disking—as well as testing the degree of tolerance to the toxic conditions in the soil of 1-year seedlings and cuttings of (*a*) *Caragana*, (*b*) Green Ash, (*c*) American Elm, (*d*) Boxelder, (*e*) Acute Willow, and (*f*) Cottonwood. Results indicated that seedlings of (*a*)–(*d*) are better adapted to the soil conditions than cuttings of (*e*) and (*f*). Results also suggested that planting species relatively tolerant of the toxic conditions of the soil may be a more practical way of increasing the productivity of such soils than attempting to correct them by chemical or cultural means. (3) *Effect of certain fungicides in eliminating losses of Scots Pine seedlings caused by damping-off fungi.* None of the treatments tested (formaldehyde, H_2SO_4 and CH_3COOH treatment of soil; Arasan, Koladust, and Spergon treatment of seed) gave consistently good results, and it is concluded that corrective methods in nursery practices and seed treatment are better measures against losses by damping-off.

4005. ALLEN, R. M., and MAKI, T. E. **Response of Longleaf Pine seedlings to soils and fertilizers.** *Soil Sci.* 79 (5), 1955 (359–62).

Pinus palustris is unique in that active height growth does not begin until ground-line stem diameter is ca. 1 in., i.e. at 5 to > 7 years, depending on site factors. Thus the tallest 12-year Pines on

eroded and non-eroded sandy-loam plots were 0·8 and 14·6 feet respectively. Seedlings were sown in pots of 3 different soils and treated with no fertilizer, N, and NPK. At 12 months they were lifted for weighing, root-pruned and transplanted into a sandy soil in a greenhouse for observation on transplanting survival and a drought test. Watering was done for the first 48 days, then withheld until the transplants were parched, and then resumed. Results (tabulated) show that seedlings differ in green weight and ability to survive transplanting with the media in which they are raised. The mean green weight of seedlings was doubled by NPK as compared with the means for N and for no fertilizer.

4006. Bokor, R., and Kardos, R. Rövid fögyökerü és bozontos talpgyökérzetü csemeték nevelése sekély talajok erdösitésére és kopárfásitási célokra. **[Raising seedlings with well ramified root systems and short tap roots, for afforesting shallow soils and barrens.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (150–2). [Hu.russ.e.g.]

The authors have produced these in peaty soils and in layers of peat 15–20 cm. thick made up in nursery beds. For longer root systems, the seedlings should be raised in 20–25 cm. of earth above a thick peat layer into which the roots penetrate.

232.324. Transplanting and Lining Out, including Grading of Seedlings

4007. Wilde, S. A., and Voigt, G. K. **Morphological and physiological analyses of nursery stock.** [*Paper*] *Forest Insect and Disease Conference, Wisconsin University* 1954. pp. 4. 9 refs.

Summarizes the analytical procedures for determining the morphological and physiological characteristics of seedlings (with an illustrative example), under the heads: colour, height, coefficient of variation, stem diameter, oven-dry weight, shoot/root weight ratio, mycorrhizae, sp. gr. of stems, transpiration loss of crowns, 'titration value' of root system, absorption/transpiration quotient, ash content, content of nutrient elements, organo-solubles.

4008. Kardos, R. Fenyöcsemeték hibás ültetésének gyakorlati hatása. **[Practical effects of defective transplanting of coniferous seedlings.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (148–9). [Hu.russ.e.g.]

The collar of seedlings of Scots and Austrian Pine may be set as much as 1 cm. lower or higher in the transplant bed without affecting rooting or survival, but careless practices such as bending back the main root may seriously retard development or even prove fatal.

232.325. Tending (in both Seedbeds and Transplant Beds)

See also No. 4015.

4009. Bokor, R., Kardos, R., and Sass, Z. A fenyöcsemete nevelés módszerei—különös tekintettel az öntözésre. **[Methods of raising coniferous plants with special regard to irrigation.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (58–64). [Hu.russ.e.g.]

Afforestation of the Alföld with Scots and Austrian Pine should be done with seedlings raised in nurseries situated there. Shade and irrigation are essential; for Scots Pine, irrigation should not exceed 50% of field capacity, for Austrian Pine 80%. The latter benefits from shade.

4010. Bencze, P. Az erdeifenyöcsemete legkedvezöbb öntözövízszükségletének meghatározása tenyészedényekben. **[The optimum amount of irrigation water for Scots Pine seedlings in the growing season.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953) (139–47). [Hu.russ.e.g.]

For post-cotyledon seedlings this was represented, by a field moisture capacity of 50% by volume (readily ascertained by Bokor's method). A figure exceeding 70–80% was harmful. The minimum for any growth at all was thrice the hygroscopic water content.

4011. La Croix, J. D. **The morphological effects of petroleum naphtha on Pine seedlings.** *Abstr.* in *Proc. Indiana Acad. Sci.* 62, 1952 (100). A.P.B.

Greenhouse experiments with *Pinus elliottii*, *P. strobus*, *P. resinosa* and *P. sylvestris* showed that the use of Standard Weed Killer at ca. 70 gal./acre caused little damage if applied while the seed coats were still on the cotyledons or after the trees had reached one year of age. Heavier dosages damaged seedlings in both pre-emergence and post-emergence treatments. Pre-emergence sprays reduced germination in all species, and Slash Pine with seed coats was intolerant. Applications on 5- to 9-month-old Slash Pine resulted in needle burning and severe damage to leaves, growing point, and cotyledons. One-year-old White Pine were particularly susceptible.

232.327. Protection Measures in Nurseries

See also Nos. 4004, 4022–3, 4216–20, 4261, 4346, 4354.

4012. Newhall, A. G. **Disinfestation of soil by heat, flooding and fumigation.** *Bot. Rev.* 21 (4), 1955 (189–250). 15 pp. of refs. [Dept. of Plant Pathology, Cornell University, Ithaca, N.Y.]

A review of literature (mainly in English) under the heads: application of heat, and thermal death points of pathogens (dry heat, steam, hot water, electric sterilizers); flooding; soil fumigation (CS_2, chloropicrin, D-D, $C_2H_4Br_2$, MeBr, formaldehyde and miscellaneous fumigants; development of fumigant dispensers); chemical and biological changes induced by soil disinfestation.

4013. Molin, N. Fallsjuka på groddplantor av barrträd. **[Damping off of conifer seedlings.]** *Medd. SkogsforsknInst., Stockh.* 45 (7), 1955. pp. 12. 12 refs. [Sw.sw.e.] Price *Kr.*1.

Laboratory tests were made on the effect of various fungicides on the germination of Pine seed and on the growth of pure cultures of a number of soil fungi. In greenhouse experiments, Pine seeds were treated with fungicides and sown in soil inoculated with soil fungi, and seed treated with 5 of the fungicides giving the best results in the laboratory and greenhouse

was sown in the nursery. Results, given in tables with English legends, show that Cu-8-quinolinate, tetramethyl thiuramdisulphide and tetrachlor-*p*-benzoquinone are promising for control of damping-off fungi. Field experiments on sowing Pine and Spruce in beds treated with a 40% solution of formalin at 0·5 litre/sq. m. showed promising results for controlling both damping-off fungi and weed growth.

4014. Gibson, I. A. S. **Potassium permanganate as a seed bed treatment against damping off in Pines.** *E. Afr. agric. J.* 20 (3), 1955 (176–7). 5 refs.

Treatment of *Pinus patula* and *P. radiata* seedlings with 0·6% solution of $KMnO_4$ at 0·5 gal./sq. yd. every 2 (in one case 7) days, clearly indicates that the salt has little effect in reducing mortality due to *Rhizoctonia solani* and *Pythium ultimum*. In 2 out of 3 cases with *P. patula* a marked increase of loss occurred with the application, probably due to the increased alkalinity of the soil, which favours these genera of fungi.

4015. Sato, K., Ota, N., and Shoji, T. **[Relation between weeds and damping-off of coniferous seedlings caused by *Rhizoctonia solani* in forestry nurseries.]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 77, 1955 (1–14). 9 refs. [Jap.jap.e.]

Gives a list of 50 weed hosts, 5 of which are very susceptible. Conifer seedlings of many species are also infected in dark and moist conditions. A table shows for *Cryptomeria japonica* significant improvement (in survival, freedom from attack, growth of root and shoot) when beds were weeded 3–4 times. Most damage occurred when temperature and humidity were high. The many isolates obtained from weeds showed a great range of virulence to seedlings of *Pinus densiflora* and *P. thunbergii*, but these two Pines did not significantly differ in susceptibility. [Tables and figures have English legends.]

232.328. Vegetative Propagation

See also Nos. 3989, 4067, 4109–10.

4016. Brandstaetter, M. **Mist propagation reviewed during Lake County School.** *Amer. Nurserym.* 101 (7), 1955 (52–9).

Summarizes two papers: Factors affecting propagation under mist (*C. Hess Jr.*); Recommendations for the installation of a mist system for rooting cuttings of nursery crops (*C. Hess Jr.* and *W. E. Snyder*).

4017. Boer, S. de. Het stekken van boomkwekerij gewassen. **[Propagating tree and nursery plants by cuttings.]** Proefstation voor de Boomkwekerij, Boskoop. 1955. pp. 123. [Du.]

Discusses, for each of a large number of mainly ornamental trees and shrubs, methods and times, soil media and the use of growth regulators; recommendations are summarized in tabular form. Trees dealt with include *Acer* spp., *Ilex* spp., *Juniperus* spp., *Metasequoia glyptostroboides*, *Picea* spp., *Populus canescens*, *Robinia pseudoacacia*, *Thuja* spp., *Tilia europaea* and *Ulmus carpinifolia*.

4018. Severova, A. I. Vegetativní rozmnožování jehličnatých dřevin. **[The vegetative propagation of conifers.]** *Lesn. Knihovna* (*malá Řada*) No. 23, 1953. pp. 50 + [1]. 29 refs. [Cz.] Price *Kčs*.20. [Translated from Russian.]

Describes the methods and tools used for propagation by cuttings and grafting. A table supplies information on the rooting ability of cuttings of 20 species of coniferous trees and shrubs, according to Soviet research workers.

4019. Fielding, J. M. **Methods of raising Monterey Pine [*Pinus radiata*] from cuttings in the open nursery.** *Bull. For. Timb. Bur. Aust.* No. 32, 1954. pp. 29. 10 refs.

The most important factors influencing the strike of Monterey Pine cuttings are the age of the tree from which the cuttings are taken, the inherent nature of the tree and the season of collection. Others are the nature of the rooting medium, the type of branchlet employed, the length of the cutting, the depth to which it is set, the water supply and basal aeration of the cutting. Cuttings from young trees, in general, give a much higher strike and grow more rapidly in the nursery than cuttings from old trees, but a large inherent variation appears to exist; no association has been found between this variation and that of any other characteristic of the tree.

Cuttings are best collected when the terminal buds are resting, and, if practicable, after the heat of the summer. Branchlets that are purely foliar should be collected in autumn or early winter, but those whose buds contain primordia or staminate catkins are best collected in late summer or early autumn. On young trees the most vigorous branchlets make the best cuttings. Thus first-order branchlets are, in general, better than second-, and second- better than third-order. However, first-order branchlets are usually not employed, but are left on the tree to continue the growth of the branch. On older trees, the order of the branchlet does not appear to be very important; the rooting ability of cuttings consisting of 2, 3, or 4 annual shoots has proved approximately the same. Cuttings consisting of one annual shoot and sufficiently long are rare or difficult to collect. Cuttings consisting of > 4 annual shoots have proved less successful. In the Australian Capital Territory the branchlets are either cut from the tree with secateurs or pulled from the tree and later cut to length with a sharp axe or secateurs. The needles are not stripped from the base of the cutting.

Cuttings raised in nursery beds at Canberra are poorly rooted and have suffered severe establishment losses in the plantations of the Australian Capital Territory. In addition, the raising of cuttings from old trees has proved very difficult in nursery beds in Canberra. To overcome these difficulties, a method has been developed for raising cuttings in galvanized-iron planting tubes. Tubes 6 in. long and $1\frac{3}{4}$ in. in diameter are used. They are filled with soil of open structure and containing a large amount of organic matter. Cuttings ca. 6 in. long are set at a depth equal to half their length in the tube soil. No growth-regulating substance is used. The tubes are placed in the open nursery in rows ca. 1 ft. apart,

the individual tubes of each row touching each other. The base of the tube is set no deeper in the soil of the nursery than is necessary to keep the tube upright; it is preferable to set the base on the surface of the soil or to place the tubes on concrete beds. The tubing method is more expensive than raising the cuttings in nursery beds, but it yields a relatively high strike and the tubed plants suffer very few establishment losses in the plantation. *From author's summary.*

4020. HATCHER, E. S. J., and GARNER, R. J. **The production of sphaeroblast shoots of Apple for cuttings.** *Rep. E. Malling Res. Sta. 1953/54*, 1955 (73–5 + 3 photos). 5 refs.

Sphaeroblasts were produced by pruning and completely disbudding maiden and 2-year nursery trees (Malling Crab C). The best time for disbudding was towards the end of the dormant season. Degree of pruning and age (1 or 2 years) of tree had little effect on sphaeroblast production. With optimum treatment, sufficient growth had been made by the second season to yield some 25 hardwood cuttings per tree.

4021. PEASE, R. W. **Rooting Chestnuts from softwood cuttings.** *Rep. Nth. Nut Growers' Ass.* No. 44, 1953 (56–9). E.M.B.

Presents preliminary results of work at the West Virginia Agricultural Experiment Station, Morgantown.

4022. WATERMAN, A. M., and ALDRICH, K. F. **Additional information on the surface sterilization of Poplar cuttings.** *Plant Dis. Reptr.* 38 (2), 1954 (96–100). A.P.B.

Reports further experiments to find suitable preparations for the sterilization of Poplar cuttings [cf. *For. Abstr.* 14 (No. 1160)]. The following precautions against injury should be taken when treating with 5% $HgCl_2$/alcohol solutions without rinsing: cuttings not to be dipped longer than 4 seconds, $\frac{1}{2}$ in. to be cut off each end before planting, storage period after dipping not longer than 2 weeks, cuttings to be planted preferably within a week after dipping. Of 12 chemicals tested, Semesan (30% hydroxymercurichlorophenol), and Ceresan M (7·7% ethyl mercury *p*-toluene sulfamanilide) proved best and may be better than the 5% $HgCl_2$/alcohol solution.

4023. FORD, H. F., and WATERMAN, A. M. **Effect of surface sterilization on survival and growth of field-planted hybrid Poplar cuttings.** *Plant Dis. Reptr.* 38 (2), 1954 (101–5). A.P.B.

[Cf. preceding abstract.] Survival and height growth were studied in cuttings treated with (1) 5% $HgCl_2$ solution in 70% alcohol, rinsed; (2) ditto, not rinsed; (3) Ceresan M 2% suspension in water; (4) Semesan 1% suspension in water; and (5) untreated controls. Poorest survival was produced by (1) and then (2). With (4) survival was as good as in untreated controls, while with (3) an average of 24% died in the field tests. Although none of the treatments retarded or stimulated growth to a degree likely to be of importance, there was a noticeable difference in the effects of Semesan and Ceresan M, the greatest average height growth occurring with cuttings treated with the former, and least in those treated with the latter. The recommended treatment therefore is complete immersion in a 1% water suspension of Semesan for a period of 20 min. No rinsing is necessary before preparation for shipment.

4024. VAŠKULAT, P. N. Vegetativnoe razmnoženie barhata amurskogo. [**Vegetative propagation of *Phellodendron amurense*.**] *Lesn. Hoz.* 5 (9), 1952 (25–9). [Russ.]

Work done in 1937–51 at various experiment stations in the steppe region showed that vegetative propagation of *P. amurense* by lignified and unlignified shoot cuttings, was impracticable without growth regulators. Only unlignified cuttings with a 'heel' gave even as much as 10–13% rooting in the open ground; in this type of cutting, abundant callus is formed, roots developing along the line between the old and new wood, as well as from the callus itself. On the other hand, more than 50% rooting has been obtained in the open ground with root cuttings 25 cm. long and $\leq 0{\cdot}5$ cm. diam. Root cuttings only 2–3 cm. long have been rooted (ca. 23%) in frames, but here the process takes longer, the first shoots appearing as late as July–August; at the end of the season they are only 3–5 cm. long and insufficiently lignified, requiring careful winter storage.

4025. PIRONE, P. P. **Air layering as a method of plant propagation for arborists.** *Proc. nat. Shade Tree Conf. 1954*, [1955] (113–32). 4 refs.

Deals particularly with the use of 'Airwrap' Krene plastic film, which was found to be more satisfactory than polyethylene plastic film for this purpose.

4026. MERGEN, F. **Air-layering of Slash Pines.** *J. For.* 53 (4), 1955 (265–70). 18 refs.

[Cf. *For. Abstr.* 15 (Nos. 1301–2).] Sturdy, straight, 10- to 15-in. branch terminals were girdled (0·25–0·5 in. wide) after removing needle fascicles. The girdle was scraped free of cambium and a mixture of 0·8% indolebutyric acid powder in talc (Hormidone 3) was dusted on the upper rim. A handful of moist sphagnum and a polyethylene sheet were used to cover the marcot. A total of 52 marcots (with or without Hormidone) was made on 26 trees, in Oct., May and August. Those treated produced on average 4 times as many roots as the untreated and the % take was 84·6 against 50. For both these factors and for the number of weeks to first root development, August proved the best month (8·1, 92% and 6 weeks respectively) and Oct. the worst. The polarity and response to warmth, of root development are discussed, and root development in marcot and stem cuttings is illustrated. These marcots save labour and time (2 years) as compared with cuttings.

4027. SINGH, S. N. **Studies on the rootage of fruit plants in relation to hormones. IV. *Artocarpus heterophyllus* Lam.** *Sci. & Cult.* 20 (8), 1955 (393–5). 5 refs. E.M.B.

Of 18 treatments of marcotted shoots using β-indolyl butyric acid, β-indolyl acetic acid, and α-naphthalene acetic acid, pure and in mixtures of

various composition and strength, the first, in 1% solution, gave the best results. Wood should be 24–30 months old. Apical, semi-hard and hard-wood cuttings treated with similar substances failed to root.

4028. Chase, S. B., and Galle, F. C. **Pine grafting: a preliminary report**. *Tech. Note Tenn. Vall. Auth.* No. 18, 1954. pp. 5 + 8 photos.

Preliminary report on a study of nursery and greenhouse grafting of seedling Pines (*Pinus echinata*, *P. taeda*, and *P. strobus*). Results indicate that bottle grafting is more satisfactory than side grafting in nursery conditions, and side grafting than wedge grafting in the greenhouse.

4029. Ravensberg, K. Het zetten van berken. **[Grafting Birches.]** *Jaarb. Proefsta. Boomkwek. Boskoop 1953*, [1954] (28–30). [Du.]

Experiments in grafting *Betula pendula* var. *youngii* on to *B. pendula* and *B. pubescens* showed that mortality was lowest on stocks potted up in the previous year, and that grafting in November gave better results than grafting in February. *B. pubescens* was generally the better stock.

4030. Boer, S. de. Proeven over het enten van noten 1949–1953. **[Experiments on grafting Walnuts, 1949–53.]** *Jaarb. Proefsta. Boomkwek. Boskoop 1953*, [1954] (35–40). 5 refs. [Du.du.]

The following results were obtained from grafting under glass: (1) *Juglans nigra* stock gave slightly better results than *J. regia*; both, however, were good. (2) 1-year stocks were better than 2-year. (3) Stocks with the roots packed in moss in January or February and kept in a heated frame, flushed as soon as those potted up in November and kept from December in a heated frame. (4) The stage of development of the stock (i.e. the breadth of the leaf rosette) had little effect on the growth of the graft. (5) The basal and middle parts of long shoots with little pith make the best scions. (6) February-March is the best period for grafting. (7) The method of grafting has little effect on development of stock and scion. [Cf. *For. Abstr.* 13 (No. 1165).]

4031. MacDaniels, L. H. **Some aspects of the problem of curly-grained Walnut**. *Rep. Nth. Nut Growers' Ass.* No. 44, 1953 (72–9). 9 refs. E.M.B.

Discusses causes of the formation of curly grain and problems connected with the production of curly-grained Walnut logs by grafting.

4032. Krahl-Urban, J., and Pott, H. Erfahrungen bei Eichen- und Buchenpfropfungen. **[Grafting Oak and Beech.]** *Z. Forstgenet.* 4 (2), 1955 (58–64). [G.g.e.f.]

A report on experience gained since 1950 at the Bramwald Forestry Centre in grafting Sessile Oak, Pedunculate Oak, Red Oak and Beech.

4033. Bokor, R. Új agrotechnikai módszer az iparilag értékes fát adó ú. n. nemes nyárak tenyészterületének a kiterjesztésére a szarazabb termöhelyek felé. **[A new method for extending the use of economically valuable Poplar species to drier areas.]** *Erdész. Tud. Int. Évk.* 2, 1952 (1954), (78–89). 4 refs. [Hu.russ.e.g.]

The author grafts fast-growing hybrid Poplars, e.g. × *P. serotina*, × *P. marilandica*, × *P. robusta*, on indigenous species (*P. alba*, *P. canescens*, *P. nigra*) growing on dry sites and forming mycorrhizae. Tongue grafting on stocks brought to early shooting under glass, grafting of scions bearing only 1–2 buds on slips ca. 25 cm. long, and dormant-bud grafting (out of doors) have all proved successful; the latter holds promise for cheap afforestation with superior clones, using 1-year-old indigenous Poplar stocks planted 8 × 8 m. and grafting early in August.

232.329. Miscellaneous (including Greenhouses, Frames, Raising in Pots, Tubes etc.)

See also Nos. 4019, 4685.

4034. **Potting bench for transplanting in square pots**. *Equipm. Note, FAO* No. *A*.4.54, 1954. pp. 2.

The bench, developed and constructed at the Albuquerque Nursery, New Mexico, has proved successful for handling conifers 6–10 in. high, using 15-lb. (7-kg.) roofing felt as potting material. Four men are required as crew. The potted plants stand on the ground in rows of 20, the beds being held in place by 12-in. boards as required.

232.33. *Formation of Stands by Direct Sowing*

See also Nos. 3951–2, 3978, 4851.

4035. Derr, H. J., and Cossitt, F. M. **Longleaf Pine direct seeding**. *J. For.* 53 (4), 1955 (243–6). 2 refs.

Summarizes recent experience of 8 trials over 8000 acres scattered in Mississippi and Louisiana, on time of sowing, site preparation, quality of seed, methods of sowing and predator control.

4036. Hooven, E. F. **A field test of tetramine treated Douglas Fir seed**. *Res. Note Ore. Bd. For.* No. 21, 1955. pp. 17.

A detailed account of direct sowing of tetramine-treated seed on part of the Tillamook Burn. Field germination was 35·3% for untreated and 26·8% for treated seed. Stocking one year after sowing (based on 1-milacre plots) was respectively 16 and 25%. [Cf. *For. Abstr.* 16 (No. 1942).]

4037. **[Chemical treatment of conifer seeds as a protection against rodents.]** *Rep. Pacif. Nthwest. For. Range Exp. Sta. 1954*, 1955 (10–1).

Douglas Fir treated with tetramine in acetone carrier and sown in 1951 and 1952 showed good survival and vigour in 1954; the area sown in 1952 was 62% stocked compared with 40% for a near-by area sown with untreated seed. In trials with Sugar and Ponderosa Pine, tetramine in dextrin proved effective against rodents without reducing germination. Six times as many seed spots with treated Ponderosa Pine seed germinated as those with untreated seed and the difference was even greater for Sugar Pine.

4038. Allen, G. S., Barber, I. K., and Mahood, I. **The 1951 aerial baiting and seeding project, Ash River Tract, MacMillan and Bloedel Limited**. *For. Chron.* 31 (1), 1955 (45–59). 18 refs. Also (shorter version) in *B.C. Lumberm.* 39 (2), 1955 (86 . . . 93).

An area of 738 acres about 20 miles north and west of Port Alberni on Vancouver Island was sown by helicopter to Douglas Fir ($\frac{1}{2}$lb./acre) and Western Hemlock ($\frac{1}{5}$ lb./acre) in Nov. 1951. One week earlier this area and a surrounding buffer strip, totalling 1760 acres, had been baited by helicopter, using wheat treated with thallous sulphate and '1080'. Baiting was successful and the rodent/trap ratio dropped from 1/4·6 to 1/94·3 as a result. By April the ratio had climbed again to 1/18·7. By early June 1952, a total of about 1400 Douglas and 840 Hemlock had germinated per acre. By Nov. 1952, this had dropped to 1000 Douglas and 198 Hemlock. A final extensive survey in June 1954, showed a total of 730 Douglas and 57 Hemlock of the 1952 crop per acre with a milacre stocking of 42·0% for Douglas and 43·9% for Douglas + Hemlock. The 4-milacre stocking due to the 1952 Douglas seedlings was 78·3%. Practically all the seedlings that germinated in 1952 are attributed to the sowing operation, because of the relatively uniform distribution of seedlings and the lack of seedlings on the control area. The sowing operation in itself restocked 628 acres to B.C. Forest Service minimum standards (31% by 1-milacres). It restocked 708 acres to U.S. 'medium' or 'good' standards. With natural trees included, only 28 acres are below B.C. Forest Service standards, and 6 acres below U.S. 'medium' stocking. Total stocking, including natural trees, is 59·3% by 1-milacres and 88·6% by 4-milacres. The baiting and sowing operation can be considered highly successful. The surviving Douglas Firs are healthy and vigorous and show little deer or grouse damage to date. Seedling distribution is good and most gaps that occurred are believed to be due to uneven local distribution of seed. Considering that this experiment was carried out on a rather steep, south exposure and that the first summer following sowing was unusually hot and dry, the satisfactory results suggest that direct sowing following rodent control has a definite place in West Coast forestry practice. It may well take the place of more expensive and troublesome planting on many areas that are slow to restock. *From authors' summary.*

4039. Pesterev, A. P. Aèrosev kak sposob lesovozobnovlenija vyrubaemyh ploščadeĭ na Severe. **[Aerial sowing as a means of restocking felled areas in the North of Russia.]** *Lesn. Hoz.* 5 (9), 1952 (29–32). [Russ.]

In the *taiga* forests the first large-scale trials of aerial sowing were made in May 1940 and 1941. In 1940, Scots Pine was sown on 420 ha. in the Totemsk lespromkhoz, using 1·3 kg. seed/ha., in strips 20 m. wide at 20-m. intervals, previously marked on the ground. Counts in autumn 1941 gave an average of 25,800 seedlings/ha.; the highest density (37,300/ha.) being recorded on hummocky swamps and the lowest (1330/ha.) on low-lying ground having a dense cover of grass. In May 1941, ca. 1000 ha. were sown in the same district with 902 kg. of Pine, 148 kg. of Norway Spruce, and 170 kg. of Larch seed at an average rate of 1·2 kg./ha. Counts in 1943 showed that the number of seedlings per ha. varied from 1400 to 10,167/ha. according to site and other factors. In the Biryakov lespromkhoz 1072 ha. were sown in May 1941 with 908 kg. of Pine and 1098 kg. of Spruce seed; counts in July, 1941, showed an average of 19,367 seedlings/ha., and in 1942, 26,855/ha., of which 14,650 were Pine and 12,205 Spruce. The advantage of aerial over hand sowing is the saving in labour (0·2 versus 2·9 man-days/ha.) and seed (1·3 versus 1·5 kg./ha.), and also the more even distribution of the seed. It is important to sow early in spring, while the ground is under snow or is still moist, so that the seed may be washed into the soil. Seed was sown without previous ground preparation, the good results obtained being attributed to the surface of the ground having been disturbed and some of the grass and moss cover torn off and destroyed in the course of mechanical logging and of slash burning.

4040. Marakulin, I. V. Osennie gnezdovye posevy duba nakljunuvšimisja i prorosšimi želudjami v Belorusskoĭ SSR. **[Autumn 'nest' sowings of germinating and germinated acorns in the Belorussian SSR.]** *Lesn. Hoz.* 5 (8), 1952 (19–23). [Russ.]

In spite of rodent, chafer and late-frost damage, these gave better results as regards height, diameter and depth of root penetration, than autumn and spring sowings with ungerminated acorns.

232.4. Formation of Stands by Planting

See also Nos. 3951–3, 3978.

232.41. *Planting Stock (Type, Handling and Treatment)*

See also Nos. 4006, 4045.

4041. Stefansson, E. Några resultat av höstplantering med tall. **[Some results of planting Scots Pine in autumn.]** *Norrlands SkogsvFörb. Tidskr.* 1954 (4), (567–96). 6 refs. [Sw.]

Preliminary trials in 1946 indicated that 2 + 1 Pines survived better when planted in August–September than 2 + 0 plants. Further trials were carried out in 1948–51 on 14 sites. The plantings in 1951 were made on 1 and 9 Sept. and 1 and 9 Oct. on each of 5 sites; in 1948 and 1950 planting dates ranged from 1 to 29 Sept. on different sites. Results showing mortality of 2 + 0 and 2 + 1 plants after 1 and 2 seasons are tabulated, and the results for each site in relation to climate, weather during the period, soil, planting method, insect attack etc., and any obvious cause of failure are discussed. Statistical analysis showed significant superiority of 2 + 1 over 2 + 0 plants. No significant difference emerged for different planting dates, but with some plantings there was a clear tendency to better results for the later dates especially with 2 + 0 plants. The superiority of 2 + 1 plants was particularly marked on sites with heavy grass cover; in one series 2 + 0 plants gave better results on a site with light grass cover than on a bare heavily burnt site. Resistance to attack by *Hylobius* and to frost was greater among 2 + 1 than among 2 + 0 plants. The most important advantage of 2 + 1 plants for autumn planting is their greater resistance to drought, but 2 + 0 plants also need greater care in handling and treatment before planting.

4042. CURTIS, R. O. **The use of graded nursery stock for Red Pine plantations.** *J. For.* 53 (3), 1955 (171–3). 7 refs.

In 2 + 1 stock graded as large, medium, and small, the large plants still maintained the best growth at 12 years. Two planting methods were studied but these gave only slight differences in survival, growth, and frost heaving. Since the presence of some slower growing trees results in an earlier expression of dominance and thus delays the need for thinning, the stock should not be graded.

4043. JACOBSSON, F. Vinterförvaring av höstupptagna plantor. [**Winter storage of plants lifted in autumn.**] *Skogen* 42 (7), 1955 (126–7). [Sw.]

Preliminary results are given from N. Sweden showing mortality by autumn 1954 of 2 + 0 Pine plants lifted the previous autumn and stored through the winter either (*a*) heeled in at the planting site in bundles of 100 and sprayed with a 3% solution of lime-sulphur against *Phacidium infestans*, or (*b*) in boxes buried in the snow at the planting site with successive layers of thin tarred paper, Spruce or Birch branches, and 1 in. of hard packed snow over them, with branches piled over the mound to prevent snow melting. All the plants were healthy when planted out at the normal time or one month later except that the (*a*) plants at 2 of the 11 planting sites were suffering from snow scorch. The advantages to the supplier and planter of winter storage of autumn-lifted plants (especially by method (*b*)) are discussed. The method, though still in the research stage, was successfully applied by Kramfors A.B. in 1954 with 80,000 plants.

4044. VAARTAJA, O. **Storage moulding of Maple seedlings.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 11 (1), 1955 (3).

Mortality of *Acer negundo* seedlings is often high during winter storage in cellars in Manitoba and Saskatchewan; by spring the roots appear to be dry and are covered with green mould. Pre-storage treatment with fungicides had no effect. Seedlings taken in the spring, moistened, wrapped as for shipping, and kept for a further 2 weeks before planting, responded well, and it is suggested that the damage is caused primarily by drying of the roots, and could be mitigated by moistening the seedlings during storage.

232.42. *Methods of Planting (including Use o Fertilizers etc.)*

See also Nos. 3886, 4072.

4045. BARNARD, R. C., and SETTEN, G. G. K. **'Notch' and 'patch' planted wildings [of *Dryobalanops oblongifolia*].** *Malay. Forester* 18 (2), 1955 (85–8).

Planting trials were carried out at monthly intervals, with wild seedlings, some entire and some with leaves reduced to about ⅓ of their length to reduce transpiration. Planting was done with a crowbar, in slits, on both unprepared and cultivated patches. Best results were obtained by transplanting 1- to 12-month-old 'entire' wildings into cultivated patches, but the difference in survival and height growth between cultivated and uncultivated patches does not justify the cost of cultivation.

4046. DOMMERGUES, Y. Influence de la fumure des plants d'*Eucalyptus robusta* sur la croissance de cette essence et sur l'activité biologique du sol. Interprétation de l'analyse bactériologique des sols. [**Influence of fertilizing transplants of *E. robusta* on the growth of this species and on the biological activity of the soil. Interpretation of an analysis of soil bacteria.**] *Mémoires de l'Institut Scientifique de Madagascar, Tananarive* 5*D*, 1953 (315–25 + 1 plate). 7 refs. [F.] H.S.B.

Presents the results of experiments at the Ampamaherana Experiment Station. Fertilizing the transplants in pots, or adding fertilizer when ball planting, causes an improvement in the soil, consisting mainly of an increased capacity for N fixation, lasting over many years. At 50 g. of organic fertilizer per pot the rate of application works out at ca. 100 kg./ha. Mineral fertilizer such as phosphates, may also be added.

4047. CALLIN, G., and HANSSON, J.-E. En orienterande studie över tidsåtgången vid plantering. [**A preliminary study on time taken in planting.**] *Skogen* 42 (8), 1955 (162–5). [Sw.]

Trials were made during the summer of 1954 on the times taken in planting some 15,000 plants on 18 sites in N. and S. Sweden, using different tools, many of which are illustrated, and methods. A new tool, the 'SFI mattock', which has a blade with sharp side edges curving inwards, was faster than the other tools on most soils, both for removing the humus and for planting. On lighter soils the 'Boden mattock' also gave good results, and on the lightest soils where no site preparation was necessary before planting, the Boden mattock and a one-man auger gave quick planting times. Survival and growth after one season were similar for 3 different combinations of tools for removing the humus and planting 3 + 0 Spruce and 2 + 0 Pine and for planting with SFI mattock and auger without removing the humus for 3 + 0 Spruce, survival here being poorer for 2 + 0 Pine. Results using the SFI mattock either for planting alone, or for removing the humus and planting, were equal to or better than those from the other methods. Trials will be continued in 1955, and some stonier soils will be included.

4048. CALLIN, G., and HANSSON, J.-E. Om ansträngningsgraden vid planteringsarbete. [**The degree of exertion in planting.**] *Skogen* 42 (9), 1955 (182). [Sw.]

Average figures for pulse rates during planting by the different methods investigated [see preceding abstract] are tabulated. They show that the work is fairly heavy, comparable with felling small wood without barking, but that effects vary widely with individuals.

232.43. *Spacing and Arrangement in Plantations*

See also No. 3930.

4049. ŠÁLEK, C. Výsledky hniezdového spôsobu zalesňovania pri premenách smrekových monokultúr v obvode SLH Čadca. [**Results of the 'nest'**

method of regeneration in the transformation of pure Spruce plantations in the Čadca forest district.] *Les, Bratislava* 2 (4), 1955 (135–43). [Slovak.]

In 3 consecutive seasons beginning with autumn 1951-spring 1952, the proportion of 'nest'-planted areas was increased from ca. 50 to ca. 90%; the survival % increased more for nest planting than for conventional planting. The results of nest planting are given for: (*a*) worked or unworked soil; (*b*) tended and untended plantations. For worked soils, the height increment over a 2-year period (mean of all species tested) was found to be ca. 2·3 times that on unworked soils. Maximum increment was found for nest plantings where the nests were cultivated before planting. Species doing well in nest sowing are: *Abies alba*, *Pinus sylvestris*, *Quercus robur*, *Fagus sylvatica*, *Acer* sp., *Fraxinus excelsior*, *Tilia* sp., *Alnus* sp. and *Betula alba*. It is better to sow seed of these species in drills within the 'nests' rather than in a quincunx of seed spots or broadcast. If planting is done, the nest method should be used for: *A. alba*, *P. sylvestris*, *F. sylvatica*, *Q. robur*, *Acer* sp., *Fraxinus excelsior*, *Ulmus* sp., *Tilia* sp., *Castanea* sp., *Juglans* sp., and *Populus* sp. The size and spacing of nests vary with circumstances, but they should be $\leqslant$ 1·2 m. square and $\leqslant$ 1·5 m. apart (edge from edge). The merits of the nest method of forest regeneration are discussed.

4050. **Initial espacements [for *Pinus caribaea*].** *Rep. Dep. For. S. Afr. 1952/1953*, 1954 (13).

With the mounting demand for pulpwood in view, a comparison was made between planting at 7 × 7 ft. plus thinning at 7 years from 890 to 300 stems/acre, with thinning of a 9 × 9 ft. planting at the same age. The loss in mean diameter growth in the closer spacing was more than compensated for by the more rapid growth following the heavier thinning, this yielding an additional 300 cu.ft./acre of pulpwood without any sacrifice in timber production.

4051. Eversole, K. R. **Spacing tests in a Douglas-Fir plantation.** *For. Sci.* 1 (1), 1955 (14–8). 4 refs.

Records from a 27-year plantation show that up to this age spacing has little effect on total stem volume, but wider spacing (*a*) greatly increases average diameter and timber volume, (*b*) produces taller dominants and co-dominants (and a higher site index on conventional bases), and (*c*) increases branch size. Data are given for 6 spacings from 4 × 4 to 12 × 12 ft.

232.44. *Season and Time of Planting*

See No. 4041.

232.5. Artificial Formation of Stands by Vegetative Propagation

See Nos. 3962, 4033, 4067.

233. *Afforestation*

See also Nos. 3842, 3897, 3927, 3957, 3964, 3975–9, 4071–2.

4052. Parry, M. S. **Planting in tropical Africa.** *Unasylva* 9 (1), 1955 (10–3).

Summarizes the principal features of the environment.

4053. Louvel, M. M. Les reboisements. [**Afforestation.**] *Bulletin de l'Académie Malgache, Tananarive* Spec. No. 1954 (43–51). [F.] L.S.

Short notes on past history of afforestation in Madagascar for (1) commercial purposes, with special reference to the use of Eucalypts and *Acacia* spp., (2) protection purposes, and (3) the restoration of degraded forest.

4054. Cueto Robayna, C. B. El *Eucaliptus* como proveedor económico, proyecto para un método de enseñanza por el sistema de autoabastecimiento. [***Eucalyptus* as a source of income, project for a method of education by a self-supporting system.**] *Boletín Oficial, Asociación de Técnicos Azucareros de Cuba, Habana* 13 (8), 1954 (447–50). [Span.] C.G.B.

Outlines a project for establishing Eucalypt plantations in country districts, to be used as a source of income for schools. An example is given of the income likely to be derived from plantations producing standard-dimension timber for house construction.

4055. Clicheroux, E., and Rémy, E. Le problème du reboisement en Basse-Saxe et quelques questions connexes. [**Afforestation in Lower Saxony and some related questions.**] *Bull. Soc. for. Belg.* 62 (4), 1955 (177–98 + 8 photos). [F.]

Describes principally the methods employed for planting on the Lüneberg Heath, as observed during a study tour.

4056. McEvoy, T. **Afforestation of peat soils.** *Irish For.* 11 (2), 1954 (65–75 + 4 photos). (Paper presented to the International Peat Symposium, Dublin, 1954.)

An account of Irish experiments, based largely on Forestry Commission experience in Great Britain, and differing chiefly in a much more extensive use of *Pinus contorta* in place of *Picea sitchensis*. A pilot experiment in the afforestation of a blanket bog is described in some detail. [Cf. *For. Abstr.* 16 (No. 1358).]

4057. [**Reforestation of the Slovenian Karst.**] *Gozd. Vestn.* 12 (9/10), 1954 (258–362). Many refs. [Sloven.croat.f.]

The whole of this issue is devoted to various topics relating to the afforestation and reforestation of the Slovenian Karst (S.K.) in the Gorizia area. The introductory article—'Bright and dark moments in the history of the S.K.' (*M. Wraber*), outlines the history of afforestation in this area since 1850. In the following article—'Excursion of forest specialists into the S.K. and Istria'—the same author describes an excursion of 50 foresters and timber specialists to 19 localities (25–27 May, 1954). The next article —'General ecological and plant characteristics of the S.K.' (same author; 25 refs., chiefly local)—describes the topography and ecological conditions of the area, its climate, geology and pedology, and discusses briefly the significance of forests in the Karst. A further article—'Principal plant communities of the S.K. with special reference to forest

management and possibilities of improvement' (same author; 20 refs., mainly Jugoslav)—describes the main plant communities: *Querceto-carpinetum orientalis, Seslerieto-autumnalis-Ostryetum carpinifoliae, Querceto-Castanetum submediterraneum, Fagetum seslerietosum autumnalis, Caricetohumilis-Centaureetum rupestris, Brometo-chrysopogonetum grylli, Seslerieto-uncifoliae-Caricetum humilis, Querceto-Carpinetum submediterraneum*, and *Fagetum submediterraneum*. In several articles—'Forest problems in the S.K.'; 'Afforestation of the Karst'; 'Better afforestation techniques'; 'Afforestation in the form of hedges (shelterbelts)'; 'Lipica, a model of improved pasture land'—*V. Beltram* supplies the following information: out of an area of 254,000 ha. only 51,000 ha. is under forest (19,000 ha. high forest, and 32,000 ha. under very open coppice and deciduous scrub); to achieve an equilibrium between the forested and non-forested area, another 38,000 ha. of Karst wasteland ought to be afforested; during 1947–53, ca. 4800 ha. was afforested and ca. 2300 ha. beaten up; incomparably better results were obtained with plants from nurseries set up near the plantations; planting holes ought to be dug long before planting, and filled with soil. 'Advantages of early autumn planting' (*M. Obradović*) deals with very successful plantings of *Pinus halepensis* and *P. pinaster* near Titovgrad (Montenegro) immediately after the first autumn rains. *P. Ziani* discusses 'Techniques of Karst afforestation' and 'Selection of species and economic principles for improving degraded areas'. The publication ends with a summary of the meeting of Karst foresters which preceded the above excursion.

4058. Héder, I. A dolomit és mészkö kopárfásitások egyes föbb iranyelvei. **[The most important principles of barren land afforestation on dolomitic and calcareous soils according to experiments to date.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (65–90). [Hu.russ.e.g.]

Within the primary division into rocky karst and earthy barrens, climatic (especially aspect) and geomorphic (zonal) subtypes must be distinguished before proper afforestation measures can be applied. These are discussed in some detail. Southern aspects in all cases present the greatest difficulty.

4059. Stefanik, L. A növénycönológia erdömüvelési vonatkozásai II. A kopárfásitás (1. rész). **[Relationship between phytocoenology and silviculture II. Afforestation of barren lands (Part I).]** *Erdész. Tud. Int. Evk.* 2, 1952 (1954), (121–42). 13 refs. [Hu.russ.e.g.]

[Cf. *For. Abstr.* 15 (No. 3266).] With a view to formulating basic principles for the successful afforestation of barren areas, descriptions are given of the possible plant associations at various stages of the primary succession in the secondary-chain mountains of Hungary, including the sub-associations and tree species characteristic of different habitats. On northern slopes the *Fagetum sylvaticae* generally forms the climax in the Beech zone and the *Querceto-Carpinetum* in the Oak Hornbeam zone. Under the less favourable conditions on southern slopes, succession may end with the sub-climax associations *Dictamno-Sorbetum* or *Ostryeto-Fraxinetum* in the Beech zone or even with *Festucetalia* in the Oak/Hornbeam zone. Regression due to deteriorated microclimatic and edaphic conditions following clear felling and overgrazing may lead to a reversion to *Caricetum humilis* or *Festucetum glaucae* associations and ultimately to the virginal bare rock colonized by algae, lichens and mosses. Any afforestation plan must be based on a careful selection of pioneer plants paving the way for a rapid succession of more valuable species. Thus, in the *Festucetalia*, the establishment of e.g. *Quercus petraea, Q. cerris*, and *Fagus sylvatica* (characteristic of the *Dictamno-Sorbetum* pre-climax and *Querceto-Carpinetum* climax communities) must always be preceded by the planting of shrubs (such as *Prunus spinosa, Cornus sanguinea, Viburnum lantana* etc.); direct afforestation without previous improvement of environmental conditions is doomed to failure. It is most important that the provenance of seed utilized on a site should be from an association similar to that characterizing the area to be afforested.

4060. Orlóci, L., and Tuskó, J. A Soproni hegyvidék fenyvesitésének eredményeiböl. **[Results of conifer afforestation work in the Sopron hills.]** *Erdömérnöki Föiskola Közleményei Sopron, Budapest* 1954 (1955), (41–52). 6 refs. [Hu.russ.e.]

After a description of the region, its climate, geology and soil, the history of the communal forests since 1840 is given. They were long managed as simple coppice, with a 25- to 30-year rotation, the extent of the annual coupe depending on the year-to-year needs of Sopron. Hay and litter were regularly collected, and cattle and pigs pastured. Sweet Chestnut was also widely introduced. Litter collection and pasturage was stopped in 1884, the rotation raised to 60–80 years and a regular plan for extended afforestation with conifers introduced. The main natural plant communities are listed, some recommendations made for planting conifer species, and some stand volume figures given.

4061. Nagy, K. Prispevok k zalesňovaniu sol'ných pôd. **[Contribution to the afforestation of saline and alkali soils.]** *Les. Bratislava* 2 (4), 1955 (132–5). [Slovak.]

Some solonets, and fewer solonchak, soils are found in Slovakia. The profiles of 3 soil drillings in the solonets soil on the Žitny Ostrov (Danube region) are described. Gives Sigmond's classification of saline soils, and lists species that should be used for afforesting saline soils of different classes.

4062. Ivčenko, S. I. Bereka—cennaja poroda dlja lesnyh nasaždenii v stepi. **[*Sorbus torminalis*—a valuable species for plantations in the steppes.]** *Lesn. Hoz.* 5 (8), 1952 (35–7). [Russ.]

On account of its good growth rate (height 7·5 m. at 23 years), resistance to winter and late frosts, and also to insect and fungus attack, the author recommends this species for planting on the steppes as an auxiliary to Oak. *S. torminalis*, forming a narrow crown, requires an underwood of shrubs for soil protection; having modest soil requirements and a high suckering capacity it is also valued, as a main species, for erosion-control plantations.

4063. Sanjko, P. M. Peski Polesjja i ih oblesenie. [**The sands of Poles'e [S.E. Belorussia] and their afforestation.**] *Počvoved.* 1954 (8), (89–104). [Russ.] A.P.B.

The paper is chiefly concerned with the pedology of these sands, occupying 10,100 ha. in the region of the angle between Dnieper and Pripet. Of the 12 types distinguished (and briefly described with mention of present plant cover) 6, occupying some 83% of the area, are suitable for afforestation. There are 443 ha. of shifting sand on which Scots Pine is to be raised between rows of *Salix* sp. established 1 year in advance. For the rest, Pine and Birch will be the main species, in view of the poverty and dryness of the soils, and only on the best sites will it be possible to grow the more exacting deciduous species.

4064. Sokolov, D. D. Razvedenie sosny na Tersko-Kumskih peskah. [**The raising of Pine on the Terek-Kuma sands.**] *Lesn. Hoz.* 5 (9), 1952 (18–9). [Russ.]

Description of a 38-year-old mixed plantation of *Pinus nigra* vars. *caramanica* and *austriaca*, area 0·7 ha., on the sands of the Groznyi region (N. Caucasia) with fresh groundwater at 2 m. below the surface. The stand averaged 10·5 m. high and 21 cm. in diam., with density 0·6–0·7. The plantation is believed to have been raised from notch-planted 2 + 0 seedlings, with shelterbelts of *Elaeagnus* and *Salix* planted 3 years in advance. During the early years, before the proper development of the root system, it was regularly watered from a well; a table is included giving heights (m.), diameters at root collar (cm.), and the height c.a.i. and m.a.i. (m.) of var. *caramanica* between 5 and 38 years. [Cf. *For. Abstr.* 15 (No. 2487).]

4065. Bugrov, S. V., and Bizjaev, I. A. Osvoenie astrahanskih peskov. [**Reclamation of the sands of the Province of Astrakhan.**] *Lesn. Hoz.* 5 (8), 1952 (13–6). [Russ.]

The reclamation scheme for these semi-desert regions along the western banks of the Volga will include afforestation (limited, in the case of deep sands, to group planting in hollows having ground water at 4 m. from the surface), planting shelterbelts, and establishing orchards and vineyards. Experience is so far limited to (*a*) 30- to 35-year-old 'group' plantings (up to several ha. in area), of *Robinia pseudoacacia*, *Morus*, *Tamarix* and *Elaeagnus*, now 6–7 m. high, (*b*) 1923–25 plantations including *Tamarix*, *Elaeagnus*, a stand of *Populus nigra* and 'Canadian' Poplar (mean height 15–16 m., diam. 28–32 cm. at 25 years), and a stand of *Salix* (mean height 10 m., diam. 50 cm. at 25 years), (*c*) an orchard (1 ha.) and a 3-ha. vineyard established in 1932 near Zamyany on the Volga dunes. A further important method of reclaiming bare sands is their stabilization by sowing 'sand oats', a method practised with very good results in 1909–29 (53,200 ha.) and resumed in 1949–51 (26,000 ha); the 1909–29 sowings are said to have spread by natural seeding over an area of 500,000 ha.

4066. Gončarov, V. S., Zemcova, N. M., Kulik, N. F., and Seperovič, I. P. Bogarnoe lesorazvedenie v Severnom Prikaspii. [**Afforestation of non-irrigated sites in the North Caspian region.**] *Lesn. Hoz.* 5 (9), 1952 (15–7). [Russ.]

Description of a 131-ha. plantation [age not given] at Tugai-Khuduk in the desert zone of Astrakhan Province, containing 23 tree and shrub species. Of these only *Tamarix* has formed a low closed cover. Other species more or less adapted to the environment were: *Robinia pseudoacacia*, *Morus alba*, *Elaeagnus angustifolia*, *Sophora* and 'Naryn Poplar'. Such species developed good root systems occupying 100–200 cu.m. of soil, but disproportionately small aerial parts; all coppice vigorously.

4067. Petrov, M. P. O kuljture grebenščikov [**The cultivation of Tamarisks.**] *Lesn. Hoz.* 5 (8) 1952 (23–6). [Russ.]

Brief notes on species of *Tamarix* suitable for the afforestation and fixation of sands in the dry steppe and semi-desert regions with special reference to propagation by cuttings, and the use of chemicals to stimulate rooting, which is especially important for plantations on non-irrigated sands where mortality of cuttings is high. Tureckaja recommends treatment with β-indolyl-acetic or β-indolyl-butyric acid, which stimulated rooting and raised the survival % of cuttings of psammophytic shrubs. Kertykov obtained best results by treating Tamarisk cuttings for 16–24 hours with α-naphthyl acetic acid (100 mg./litre); β-indolyl acetic acid (50 mg./litre) was also effective, and good results were given by treatment for 24 hours with $KMnO_4$ (200 mg./litre). Preliminary data on the work done in 1947 at the experiment station of the Ashkhabad railway, on cuttings of desert plants, showed that growth regulators, especially indolyl-butyric acid, resulted in a more vigorous root system and reduced the mortality of *Calligonum* and, to some extent, of *Haloxylon persicum* cuttings. Another effective method of reducing mortality, which deserves to be more generally applied, is the planting of rooted cuttings. [Cf. *For. Abstr.* 13 (No. 329); 16 (No. 3842).]

235. *Underplanting, Advance Planting etc. Nurses and Formation of Mixtures. Interplanting of Inferior Growth*

See also Nos. 3875, 3930, 3957, 4059, 4062.

4068. Brown, J. M. B. **Shelter and early growth of Beech.** *Quart. J. For.* 49 (3), 1955 (175–80 + 2 photos).

An experiment is described, in which the response to continuing shade of a young plantation of Beech raised under shelter is examined on a chalk downland site in Sussex. Trees that were wholly relieved of shade 7 years after planting have made vigorous height and diameter growth in the ensuing 7 years, but show an undesirable frequency of forks and other blemishes. Under continuing overhead shade, which intercepted 70% of the light in 1951 and > 80% in 1953, height growth was not affected, but diameter increment was retarded: on the other hand a very promising stem form was developed. An intermediate treatment, in which about 60% of the

overwood was removed in 1948, was also included. *From author's summary.*

4069. MAGYAR, J., and BIRCK, O. Az Ortástetöi fatermesztési kísérletek föbb eredményei. **[Salient results of the Ortástetö silvicultural experiments for raising timber crops.]** *Erdész. Tud. Int. Évk.* 2, 1952 (1954), (155–68). 3 refs. [Hu.russ.e.g.]

Report on three 0·86-ha. plots established in spring 1931 on a hilltop (340 m.) in the State forest district of Miskolc, carrying a 5-year-old stand of *Quercus robur* with ca. 10% Hornbeam, partly seedlings and partly coppice, on a brown forest loam. Plot I was left untended, plot II had everything removed except the Oak seedlings, which in the following year were underplanted with Beech, Plot III was similarly treated but quartered and underplanted [spacing not given] with *Picea abies*, *Abies alba*, *Pinus sylvestris* and *Larix decidua* respectively. Subsequent tending included removal of coppice shoots and light thinnings. After 20 years, crown and stem classes, d.b.h., tree heights, and volumes were determined. Plot I was in poor condition, with a high % of low-class stems. Plot II had become pure Oak, with ca. 5600 stems/ha., mean diam. 6·1 cm., height 8 m., vol. 103 cu.m. Plot III had only 4200 stems/ha. but a mean diam. of 8·4 cm., height 8·9 m., vol. 200 cu.m. Oak on the whole was prevailing over the Spruce, had completely suppressed the Fir and all but a few of the Pine (the survivors being larger than the Oak) but had itself been largely overtopped by the Larch, whose diam., height and volume growth were much superior. The data are tabulated. The indiscriminate removal of Hornbeam is deplored and suggestions for regeneration by opening out the Oak and Larch are made.

4070. SHIPMAN, R. D. **Furrows improve Longleaf survival in Scrub Oak.** *Sth. Lumberm.* 190 (2381), 1955 (70, 72).

First-year survival of one-year-old planting stock was higher (71%) on areas with furrows ca. 6 ft. apart, 8 in. deep and with a flat base 18 in. wide, with old Oaks (about 20% of the original number) left standing between the furrows, than in completely cleared areas (48% survival), those in which 45% of the Oaks were felled and the stumps poisoned (45%), or in untreated controls (57%). Soil moisture and surface soil temperature were no more favourable on the furrowed than on the other sites, and the reason for the higher survival is not clear.

236. *Care of Regeneration or Plantations in the Initial Stages of Establishment (including Regeneration Surveys)*

See Nos. 3950, 4211–2.

237. *Amelioration of Forest Sites*

4071. YEATMAN, C. W. **Tree root development on upland heaths.** *Bull. For. Comm., Lond.* No. 21, 1955. pp. 72 + 32 photos + 29 dgms. 22 refs. Price 10*s.* 6*d.*

This paper describes the methods used, the findings, and the conclusions of an investigation into the root development of the principal conifers (Japanese Larch, Scots Pine, Sitka Spruce, Lodgepole Pine and Corsican Pine) used extensively in the plantations established on the upland heaths of N.E. England and Scotland. The age of most of the plantations studied was 19–25 years. Detailed descriptions are given of the locality, geology, climate, vegetation and soil of each of the sites investigated.

In order to determine the manner in which the root systems of stands of trees, rather than those of individuals, exploited the soil in which they were planted, an extensive method of root exposure was adopted. A soil and root profile was exposed on one side of a trench 10–15 ft. long, and was plotted to scale. A scale plan diagram of the position of the trees surrounding the profile was then made, including the position of exposed surface roots. One dominant tree adjacent to the profile was selected for the complete excavation of the rootstock, which was set up to be photographed for record.

The general reactions in root development to the soil conditions, ground preparations, and applications of phosphatic fertilizers are described and discussed for each site, and the root development of the species as it occurred at each site is discussed. The outstanding fact which emerges from the study is that roots will only exploit freely soil that is sufficiently porous and well aerated. The effects of surface peat and undisturbed hardpan on root development are discussed.

In Japanese Larch, the response of the root system to the degree of cultivation was significant in all cases, but response to fertilizers was significant only on the poorest site. Sitka Spruce checked severely on all sites and soil conditions when growing in competition with *Calluna*. Its response to applications of K was noticeably greater than that of other species. The Pines proved the best colonizers of poor heathland; Lodgepole proved more vigorous in root development than either Scots or Corsican Pine. A significant response to K was observed only on the poorest site. The greatest response to the intensity of cultivation of moderately poor sites was reflected in the forms of root systems. They lost the shallow storeyed character in the more complete and deeper cultivations, which proved to be the more windfirm.

As a result of this study, desirable methods of cultivation are proposed. A pre-requisite of any method of cultivation is an adequate burn of the natural *Callunetum*. The first essential for all upland heaths is a complete cultivation of the surface in order to destroy the continuity of the surface peat and to mix and disturb the mineral soil and peat to some depth. A total cultivation depth of at least 8 in. on the normally poor sites is recommended. This will also disrupt a large proportion of shallow pan formation. The poorest sites have a relatively shallow (10–16 in.) pan over a compact subsoil, and may require, in addition, frequent subsoiling to ca. 18 in. Trees should be planted as nearly above the lines of subsoiling as possible. *From author's summary.*

4072. PERNET, R. De l'effet du labour et de la fumure dans la reforestation d'un sol latéritique. **[The effects of soil cultivation and fertilizing in the afforestation of a lateritic soil.]** *Mémoires de l'In-*

stitut Scientifique de Madagascar, Tananarive 5*D*, 1953 (229–50 + 1 plate). [F.] H.S.B.

Presents the results of studies over the years 1947–1951 at the Ampamaherina Forest Experiment Station, where the following methods were used in planting *Eucalyptus robusta* (plantations established in 1946): (1) soil cultivation with and without chemical fertilizer, added with due regard to local deficiencies, (2) hole planting, ditto. Data from these plots are compared with those from a *Pinus khasya* stand established after soil cultivation plus fertilizer, and from grassland degraded by frequent brush fires. Hole planting proved definitely superior to complete cultivation, since, in addition to being cheaper, it reduces leaching and renders the soil less liable to erosion. The addition of organic matter reinforces considerably the effects of the different fertilizers tested. Physical and chemical data for the first 20 cm. of the soil horizon are tabulated for each site and treatment.

4073. Rudolph, V. J., and Dils, R. E. **Irrigating trees with cannery waste water.** *Quart. Bull. Mich. agric. Exp. Sta.* 37 (3), 1955 (407–11).

[For the methods of pumping etc., employed in this project, see *For. Abstr.* 15 (No. 1348).] Experimental plantings have now been made on farmland on an Ottawa loamy fine sand of high infiltration capacity. Cuttings of *Salix* spp. and *Populus balsamifera*, and seedlings of *Acer negundo* and *P. deltoides* were machine planted in April 1953, at 8 × 8 ft. spacing. In addition to 16 in. of rainfall during the 1953 growing season, ca. 2 in./week of cannery waste water was applied in 32 weekly sprayings. At the end of the first year, % survival (*a*) and mean height in inches (*b*) were measured on the irrigated trees and controls, with the following results [figures in brackets are for controls]: native Willow (*a*) 58 (18), (*b*) 34 (14); hybrid Danish Willow (*a*) 48 (4), (*b*) 18 (10); *Populus balsamifera* (*a*) 4 (10), (*b*) 20 (12); *P. deltoides* (*a*) 32 (21), (*b*) 24 (16); *A. negundo* (*a*) 46 (79), (*b*) 28 (8). The lower survival of *A. negundo* and *P. balsamifera* may be partly due to the smothering effect of a rank stand of quack grass that has filled the watered area. Samples taken after one year showed a general increase in organic matter and pH value in the 0–3 in. layer. Further studies are to be made annually.

24. TENDING OF STANDS AND TREES

See also Nos. 3950, 4069.

4074. Dawkins, H. C. **The refining of mixed forest: a new objective for tropical silviculture.** *Emp. For. Rev.* 34 (2), 1955 (188–91). 9 refs.

Existing methods of tropical forest cultivation seek to improve the economic growing stock by cutting, girdling or poisoning the worst of the weeds. These techniques (except for successful poisoning) are usually incomplete, as the crop is not permanently freed of its encumbrances. Because the work has been treated as a series of separate operations, no single objective has been stated. The real objective should be a thorough refining of the forest; this term is proposed and the concept described. Forest refining means the complete elimination of lianes, weed and defective trees, shrubs and herbs, subject to silvicultural desirability and the objects of the working plan. Refining is shown to be a practical proposition since the discovery 14 years ago of effective hormonal herbicides, and their recent use as contact arboricides. *Author's summary.*

242. *Thinnings*

See also Nos. 3725, 4050, 4125, 4170–1, 4179, 4230, 4460, 4610.

4075. Aldridge, F., and Hudson, R. H. **Growing quality softwoods.** *Quart. J. For.* 49 (2), 1955 (109–14 + 6 photos + 1 gph. + 2 dgms.).

Attacks the policy of using fast-growing species and heavy thinnings to induce quick growth.

4076. Hiley, W. E. **Quality in softwoods.** *Quart. J. For.* 49 (3), 1955 (159–64). 12 refs.

A reply to Aldridge and Hudson's article [cf. preceding abstract]. The strength of wood made by a conifer depends, not on the breadth of the annual rings, but on the age of the tree when the wood is laid down. The misconception on which Aldridge and Hudson's views were based, arises from comparing broad rings near the centre of a tree with narrow rings further out. If trees can be induced to make broader rings when they are old, this will increase the average strength of the wood. Nevertheless, the thinnings which Hiley has recommended aim at 6 to 8 rings/inch, outside the rough knotty core, and this is above the minimum that Aldridge and Hudson accept. *From author's summary.*

4077. Kawada, M. **[Second report relating to the results of thinnings performed for 'Sugi' (*Cryptomeria*) stands, compared with various methods of thinning from view points of yield and composition of stands.]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 76, 1954 (81–148). [Jap.jap.e.]

Single plots, between 0·32 and 0·44 ha. in area, were laid out in a plantation formed in 1900 and thinned in 1919 [no data], by (*a*) ordinary (Terazaki's B) system, (*b*) crown (French) thinnings, and (*c*) the author's system favouring stems in all storeys. These, which are diagrammatically illustrated, were made in the 29th, 40th and 50th year. Initial (1929) and end (1950) data, [the latter in brackets] for (*a*) (*b*) and (*c*) plots, were respectively: number of stems/ha., 1110 (313), 1057 (554), 1012 (390); total 1950 yield in cu.m. 1007, 900, 1002; mean d.b.h. in cm. 22·8 (43·4), 22·4 (33·7), 22·9 (40·2); mean ht. in m., 16·3 (26·8), 16 (24), 16·4 (26·6); m.a.i. in cu.m./ha. 13·45 (20·15), 11·93 (18), 12·10 (20·05); mean tree volume in cu.m., 0·351 (1·915), 0·327 (1·124), 0·347 (1·656). Treatment (*c*) took first place in improving the timber increment and total yields in volume and price, and second place in stems/ha., mean height and diameter, and mean tree volume. Treatment (*a*) is better than (*b*). The data are presented in great detail in 30 tables with English legends, and other aspects of growth and stand composition are analysed.

4078. **Growth of 75-year-old Black Spruce after first pulpwood thinning.** *Rep. Lake St. For. Exp. Sta. 1954*, [1955] (15).

Growth was analysed 5 years after thinnings by 6 methods (heavy or light, from above, from below, or from above and below) in *Picea mariana*. A light thinning from both the upper and lower canopy, leaving a residual stand of ca. 90 sq. ft. b.a./acre resulted in the most growth, with a net increase of 3·6 cords/acre in 5 years. Recruitment of sub-merchantable trees of the intermediate and suppressed classes contributed as much as 22% of the net growth in the first 5 years after thinning.

4079. BALDWIN, H. I. **Economic thinning of Red Pine plantations.** *Fox For. Note* No. 54, 1954. pp. 1.

A light low thinning of a 20-year-old *Pinus resinosa* plantation yielded the following products per acre: 27 seven-foot fence posts, 0·8 cord charcoal wood and 0·1 cord pulpwood. Labour costs for harvesting 143 posts from 57 trees were 28·8 man-days.

4080. SMITHERS, L. A. **Thinning in Red and White Pine stands at Petawawa Forest Experiment Station, Project P-238.** *Silv. Res. Note For. Br. Can.* No. 105, 1954. pp. 52 + 1 photo. 10 refs.

Investigations on the effects of thinning Red and White Pine stands have been under way for a period of 30 years at this station. It has been found that one or two very heavy thinnings made late in the life of the stand, do not substantially increase the total production, and gross increment may be reduced by excessively heavy thinnings. The growth of selected crop trees can be greatly stimulated by intensive thinning, and the length of time required to produce merchantable sizes appreciably reduced. Such thinnings must be started early, usually at about 30 years, in order to maintain optimum growing conditions for selected crop trees. Each thinning must be light; thinnings that reduce the basal area per acre of the growing stock to less than about 70% of that for fully stocked, untreated stands, usually result in a loss of increment. A short thinning interval, ranging from five years during the first half of the rotation to 15 years during the second half, is recommended. Suggested thinning regimes for various sites are presented as guides, but it is emphasized that the success of thinning treatments will depend to a large extent upon the judgment of the forester in selecting crop trees and providing them with optimum growing conditions. *From author's summary.*

4081. WAHLENBERG, W. G. **Six thinnings in a 56-year-old pure White Pine plantation at Biltmore.** *J. For.* 53 (5), 1955 (331–9). 20 refs.

Compares in detail the growth trends of thinned and unthinned plots. Average crown ratios, mortality, sawlog and pulpwood production and price increments are covered. [Cf. *For. Abstr.* 4 (p. 104).]

4082. MCCLAY, T. A. **The relation of growth to site and residual density in Loblolly Pine pulpwood stands.** *Res. Note Stheast. For. Exp. Sta.* No. 78, 1955. pp. 2.

Data were obtained and are given in graphs, from plots in stands 25–35 years of age, subjected to treatment representing seed-tree or shelterwood felling or moderate or heavy thinning, leaving residual basal areas of 3–80 sq. ft./acre. The curves for a 9-year period after treatment show increasing p.a.i./acre with density, for densities up to 60 sq. ft. on site indexes of 70, and to 70 sq. ft. on those of 80. Whether the curve then levels out or declines is doubtful because of lack of data from high-density stands.

4083. STAEBLER, G. R. **Thinning trials have requiem.** *Lumberm.* 82 (5), 1955 (69–70).

Discusses the results obtained from Douglas Fir plots in the Kugel Creek stand, thinned and pruned at 38 years in 1937 and destroyed by fire in 1951. The records demonstrate that fire damage in thinned and pruned stands is far less serious than in unthinned stands, that at least 25 cords/acre can be cut from 38-year-old Douglas without reducing stand increment and that, after thinning, growth is concentrated on the best trees.

243. *Opening of the Canopy (Increment Fellings, Overhead Release and Improvement Fellings)*

See also No. 4240.

4084. BENNETT, F. A. **Growth of crowded 45-year-old Slash Pine after release.** *Res. Note Stheast. For. Exp. Sta.* No. 77, 1955. pp. 2. Also in *Sth. Lumberm.* 190 (2379), 1955 (31).

A study of *P. elliottii* in the George Walton Experimental Forest in south-central Georgia showed that trees with crown depth averaging only 20–25% of tree height failed to grow satisfactorily in the 5 years following release.

4085. YOCOM, H. A. **Machine faster than ax in girdling.** *J. For.* 53 (3), 1955 (205–6). 1 ref. [Southern Forest Experiment Station.]

From tests of the 35-lb. 'Little Beaver' knapsack girdler on 3140 trees, mostly Oak, 5–25 in. d.b.h., a simplified equation is: man-hours (MH) = 0·0025D (sum of d.b.h. in in.). For V-notching with an axe, MH = 0·005D. With petrol at $0·30/gal. and oil at $0·50/quart, cost is < $0·30/day and with wages at $1·00/hour, savings cover the $180 depreciation in ca. 22 days. An axeman should be provided for relief and to deal with the tough-barked Hickory and smaller trees.

4086. GODDARD, R. E. **Killing small undesirable hardwoods by use of the Cornell tool.** *Down to Earth, Midland, Mich.* 10 (2), 1954 (52). E.M.B.

A small-scale study was established in July and Aug. 1952 to investigate the usefulness of the Cornell tree-poisoning tool in releasing young Pines from competing hardwoods. Its effects were compared with those of basal spraying. For the tool a 2,4,5-T ester was used, (1) 10% in water, (2) 10% and (3) 20% in diesel oil, cuts being spaced ca. 1 in. apart around the bole. For the basal spray, (4), 2½% 2,4,5-T in diesel oil was used, the bark being wetted to the point of run-off from base to ca. 1 ft. above ground level. Treatments (2) and (3) were effective on hardwoods up to 10 in. diam.; (1) was

less so and (4) least, trees dying slowly. [Cf. *For. Abstr.* 15 (No. 267).]

4087. Swain, L. C. **Economical tree killing.** *Sta. Bull. N.H. agric. Exp. Sta.* No. 408, 1954. pp. 15.

After an account of accepted procedures (girdling, basal spraying etc.) the author describes a method evolved in the past 3 years for eliminating cull trees from a standing crop. A special tool—a small bark-peeling spud—is used to create a pocket between bark and wood, starting with a vertical slit that allows the bark to be prised away laterally for ca. 2 in. In the pocket so formed 2-in. squares of blotting paper impregnated with Ammate were inserted, giving successful kills. Similar $2 \times \frac{1}{2}$ in. tabs, soaked in Na arsenite and dried to a content of ca. $\frac{1}{2}$ g. of poison were used in extended trials, 15,000 trees being treated in this manner. Results show that Pine trees up to 4–5 in. in diameter and 15–30 ft. high may be killed with only one tab. However, if the tree is heavily branched, it is safer to insert one or two more tabs—a matter of a few seconds.

Hardwoods may be killed by the same method, but, because of their irregular branching habits and the tendency to form spreading crowns, more insertions per tree are necessary than with Pine. Hardwoods, moreover, cannot be treated throughout the year, as the bark is not easily prised away except during the normal peeling season (roughly late May to early August).

Trees treated by this method show wilted foliage in a few days and dead crowns within a month, and the poison is never any danger to human beings or wildlife. Arrangements for manufacture and distribution of treated tabs are being made.

4088. Nouvelles méthodes d'empoisonnement des arbres. **[New methods of poisoning trees.]** *Bull. Inform. Inst. nat. Étude agron. Congo belge* 4 (2) 1955 (121–6). 1 ref. [F.] (Extract from *Rapport annuel, Centre de Recherches forestières de Yangambi, 1954.*)

Three kg. of cassava flour are stirred into 2·5 litres of cold water and 4 litres of boiling water stirred into this. When the mixture has thickened evenly, it is stirred into 3 kg. of Na_2HAsO_3 (42–45% of As_2O_3) dissolved in a very little water. After a few hours the paste is sufficiently thick and sticky to apply with a wide flat brush, but the consistency may be adjusted by adding more flour or water. Method (*a*) applies the paste to a barked band-girdle 8–25 cm. wide (according to tree size). One kg. of arsenite does 10–13 m. of girth and a crew of 3 can treat 60–70 m. in a day. Method (*b*) applies the paste similarly but without removing the bark. The same task is done by one man but the effect, though probably as good, is slower. In method (*c*), dry arsenite crystals are put into a simple frill girdle. One kg. arsenite does 10–12 m. girth and a crew of 3 treat 150 m. a day. This is slower in effect than (*a*) or (*b*) but it requires no water or preparations. In method (*d*), a 25% solution of arsenite is sprayed from the base of the tree to 1·5 m. with some cuts on smooth barks so as to lodge the poison. This is slow in effect (perhaps ineffective for thick barks) and somewhat dangerous to personnel and to other vegetation. Tables show the mortality by species during each of the first eight months. [Cf. *For. Abstr.* 15 (No. 1360).]

245. *Tending of Trees, Pruning etc.*

See also No. 4109.

4089. **Research on pruning [*Pinus patula*].** *Rep. Dep. For. S. Afr. 1952/1953*, 1954 (16).

Trees of 4 and 15 years were pruned (2 localities). In the former, 84% of the knots healed in 5 and all in 10 years. In the latter, only 30% healed in 10 and 80% in 11 years. The only rot entry was from dry stubs, and in none of the 441 knots examined did this spread into the tree. Pruning should be done early and close to the stem.

4090. Skilling, D. D., and Spurr, S. H. **Costs and returns of pruning Red Pine [*Pinus resinosa*].** *Mich. For.* No. 9, 1954. pp. 2.

4091. **Pruning heights determined for young-growth [Ponderosa and Jeffrey] Pines.** *Rep. Calif. For. Range Exp. Sta. 1954*, [1955] (10–2). 1 ref. [Cf. *For. Abstr.* 16 (No. 469).] Results after 5 years of a pruning study on the Blacks Mountain Experimental Forest indicated that up to 50% of the live crown can be removed without serious reduction in diameter growth, provided that at least 40% of the total tree height is left in the live crown. Tabulated figures are given showing diameter growth for different amounts of crown removed, and recommended pruning heights for crop trees in the area by diameter and for open and closed stands.

4092. Stein, W. I. **Pruning to different heights in young Douglas Fir.** *J. For.* 53 (5), 1955 (352–5). 7 refs.

The comparison was carried out in a 28-year-old natural stand on site quality IV. Treatments were dry pruning (*a*), and live pruning to (*b*) 25, (*c*) 50, and (*d*) 75% of the live crown. The subsequent 13 years' growth in diameter and height was not significantly different in (*b*) from that in (*a*), but fell away in (*c*) and (*d*). In (*b*), growth may even have been stimulated by the removal of branches not fully efficient in photosynthesis; clear stems averaged 19·6 ft., and sun-scald, epicormic branching and reduction in crown-class status were not serious; whereas all these increased in (*c*) and (*d*). It is concluded that stands of similar age and site can be live-pruned to one-third of the crown length without incurring important disadvantages. Pruning times in minutes/tree for (*a*), (*b*), (*c*), and (*d*), using pole and handsaws, were: 12·0, 15·6, 18·6 and 25·2 respectively. [Cf. *For. Abstr.* 15 (No. 271), 16 (No. 470).]

4093. Clark, F. B. **Black Walnut responds to pruning.** *J. For.* 53 (5), 1955 (362–5).

The leaf area on felled trees was found to be about equal for all branches, beyond the point where the branch was 0·5 in. in diameter, and this leaf area was taken as a unit of crown. Counts with this unit were made on 14-year trees, 3, 4, and 5 in. in d.b.h., which were then pruned on this basis to 25, 50 and 75% of their live crowns. The average

heights to the first branch of the trees so pruned were respectively 9, 11, and 14·2 ft. (unpruned and dry-pruned 2 and 5·2). Average total height (720 trees) was 23·7 ft. In two years the fastest diameter growth was in the 50% group and the fastest height growth in the 75% group, but the latter suffered significantly in diameter growth compared with unpruned trees. Pruning increased diameter growth at 9 ft. All wounds healed rapidly and healthily. Epicormic branching is probably the limiting factor. It increases with severity of pruning and is reduced by shade. [Cf. *For. Abstr.* 15 (No. 273).]

4094. AHOLA, V. K. Silmukarsinta. **[Bud pruning.]** *Metsät. Aikak.* 1955 (3/4), (85–6). [Fi.e.]

Recent experiments on bud pruning on different site types show that completely branchless high-grade timber can be obtained from Pine. Definite results are not yet available for Spruce. Costs are high but the method is suitable for e.g. farm forests. *From author's summary.*

26. COMBINATIONS OF FORESTRY WITH AGRICULTURE AND PASTORAL HUSBANDRY (INCLUDING SHELTERBELTS AND THEIR TREATMENT)

261. *Alternate Forestry and Agriculture, Periodic or Temporary Agricultural Use of Forest Land*

See also Nos. 3871, 4827.

4095. FRITH, A. C. **No man's land.** *Emp. For. Rev.* 34 (2), 1955 (179–87). 25 refs.

It is suggested that there is a great deal to be said for the traditional system of shifting cultivation in the wet tropics, if it is not abused. Arguments are put forward to demonstrate that leaching by the concentrated 'monsoon' rains washes nutrients in the soil down to such a depth that only the tree growth can recover them and maintain fertility. Advantages and disadvantages of shifting cultivation are reviewed, as well as modern trends of thought on the rôles of organic matter and fire in tropical agriculture. Finally, some suggestions are made as to how tree growth could best be used in agricultural systems. *Author's summary.*

4096. RIQUIER, J. Étude d'un sol de tavy et d'un sol de forêt primaire à Périnet. **[Study of soil in a clearing burned for agriculture and soil under primary forest at Périnet.]** *Mémoires de l'Institut Scientifique de Madagascar, Tananarive* 5*D*, 1953 (75–92). [F.] H.S.B.

Studies of a series of soil profiles on an area felled and burned for *Eucalyptus* cultivation and one in primeval forest show that any improvement in soil conditions resulting from burning (i.e. increased availability of mineral salts to plants, and higher moisture-retention capacity of the soil) is only temporary, lasting only 1 or 2 years, after which erosion sets in. Two or 3 seasons' burning and cultivation will result in almost complete sterility of the soil.

4097. ***Acioa* fallows experiment.** *Rep. W. Afr. Inst. Oil Palm Res. 1952/53*, [1954?], (90–2).

Describes the lay-out of an experiment in the use of *Acioa barteri*, a deep-rooting rosaceous shrub, as an improvement on the natural bush fallow employed in shifting cultivation in the Benin area of Nigeria.

264. *Farm Forests*

4098. BYRNES, N. B. **Tree planting for utilization.** *Tech. Notes For. Comm. (Div. Wood Technol.) N.S.W.* 8 (1), 1954 (11–5).

Recommends trees, chiefly native, for planting by farmers for fencing and poles, timber, essential oils, tanbark, resin, pulp, firewood, fodder, shade, windbreaks, pollen and honey, fruits and nuts.

4099. JOLLIFFE, W. H. **Establishing a wood lot [in New Zealand].** *Inform. Ser. N.Z. For. Serv.* No. 18, 1954. pp. 20 + 8 photos.

Short sections on choice of species, site preparation, planting technique etc., notes on some recommended species, and a section on nursery practice.

266. *Shelterbelts, Windbreaks*

See also Nos. 3724, 3884, 3957, 3962, 4057, 4062.

4100. JENSEN, M. Lævirkning. (1). Vinden. (2). Læ—definition og betegnelser. (3). Enkelt hegn eller skærm. (4). Systemer af hegn eller skærm. (5). Skove og plantager. (6). Læbelter. (7). Landskaber. (8). Forsøgsmark. (9). Varmeforhold. (10). Vandforhold. (11). Afgrøder. **[Shelter effects: (1) The wind. (2) Shelter—definitions and terms. (3) Single hedges or screens. (4) Systems of hedges or screens. (5) Woods and plantations. (6) Shelterbelts. (7) [Natural features of] the landscape. (8) Research areas. (9) Heat relations. (10) Water relations. (11) Crops.]** *Hedeselsk. Tidsskr.* 75 (4–7; 11; 12; 14), 1954 (61–74; 77–80; 98–111; 126–35; 272–80; 293–300; 325–33); 76 (2; 3), 1955 (19–27; 39–47). [Dan.] C.G.B.

4101. CABORN, J. M. **The influence of shelterbelts on microclimate.** *Quart. J. R. met. Soc.* 81 (347), 1955 (112–5). 15 refs. E.M.B.

A review of literature.

4102. LUNCZ, G. Mezövédö erdösávok éghajlati hatásának vizsgálata 1951-ben. **[The climatic effects of shelterbelts. Results of the 1951 investigation.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (3–19). [Hu.russ.e.g.]

A detailed examination by the Hungarian Institute of Forest Sciences in 3 diverse regions of the Alföld; velocity and duration of wind, air and soil moisture, air and soil temperatures and evaporation rates, on both sides of belts. Belts < 10 m. wide are harmful. Mixed stands, including shrubs, are essential.

4103. MATSUI, Z., and YOKOYAMA, C. **[On the efficiency of the wind-break hedge in protecting the rice crop in Horomui district.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (168–77). 4 refs. [Jap.e.]

The variations in the yield of rice to the leeward of a windbreak of Willow and Ash 4 m. high (unprotected yield = 100) at distances of ½, 1, 3, 6,

9, 12, and 15 times the height of the windbreak, were − 51, + 3, + 33, + 49, + 33, + 28, and + 8%, which corresponds with the wind velocity curve of the windbreak. The protection afforded was against cold high winds.

4104. Nichols, J. E. **Shelterbelts in relation to hill farming.** *Scot. For.* 9 (2), 1955 (58–64). 5 refs.

Discusses the desirability and the planning of shelterbelts in connexion with hill farming in Britain, pointing out that the configuration of the ground usually enables sheep to find shelter, that the main problems of husbandry are to spread grazing as widely as possible during the summer, when there is a superfluity of forage, and to concentrate and supplement it in the winter. The effects, e.g. in regard to dung, of concentrating animals in the neighbourhood of shelter are also discussed. It is concluded that there are indications against elongated shelterbelts as such on hill farms where extensive stock husbandry is practical, but in favour of circular or more irregular shaped plantations only to enhance where necessary natural shelter against severe conditions from varying directions.

268. *Pastured Forests. Grazing on Forest and Open Ranges. Forage Plants etc.*

See No. 4425.

27. ARBORETA. ARBORICULTURE FOR ORNAMENTAL PURPOSES. HEDGES AND HEDGE PLANTS

See also No. 3830.

4105. Rai, G. S., and Hamner, C. L. **Inhibiting the growth of plants with maleic hydrazide.** *Quart. Bull. Mich. agric. Exp. Sta.* 37 (3), 1955 (375–86). 23 refs.

The purpose of this investigation was to determine the effectiveness of maleic hydrazide (MH) as a plant growth inhibitor, with special reference to inhibition of growth in shade trees. Foliar sprays at different concentrations were applied at different seasons to young plants of *Ulmus americana*, *Acer saccharum*, *Pinus banksiana*, *P. sylvestris*, and *Robinia pseudo-acacia*. All the treatments retarded growth to some extent, duration of inhibition being related to dosage. Addition of vinyl latex (VL) to MH gave variable results.

28. HUSBANDRY OF FOREST PRODUCTS OTHER THAN WOOD

See also section 892 and No. 4098.

281. *Christmas Trees*

4106. **Yule trees are special crop.** *Lumberm.* 82 (5), 1955 (82, 84).

Discusses the special tending methods used on a farm in Oregon producing Christmas trees from Douglas Fir, Noble Fir, Colorado Blue Spruce, Grand Fir, and Ponderosa, Scots and Austrian Pine. Points discussed include weeding, pruning, wounding the base of the tree to retard growth, and training of basal shoots left on the stool to provide further crops without replanting.

282. *Bark Crops*

4107. Brockway, G. E., and Hillis, W. E. **Tan bark Eucalypts of the semi-arid regions of South Western Australia.** *Emp. For. Rev.* 34 (1), 1955 (31–41 + 12 photos). 13 refs.

The physiography, climate, vegetation of the habitat, and the distribution and site requirements of 7 tannin-bearing Eucalypts are given, viz. *Eucalyptus astringens*, *E. gardneri*, *E. falcata*, *E. occidentalis*, *E. spathulata*, *E. brockwayi*, and *E. dundasi*. Their silviculture is discussed, in particular that of *E. astringens* (Brown Mallet). Existing data [tabulated] indicate that Brown Mallet may be as profitable as Wattle as a source of tannin, its timber is more valuable, being a satisfactory substitute for Hickory, and it is less exacting in its requirements and should prove valuable in afforestation. *From authors' summary.*

4108. Strokov, V. V. Uskorennoe naraščivanie i promyšlennyĭ s'em kory probkovogo duba. **[Accelerated growth and stripping of Cork Oak bark.]** *Lesn. Hoz.* 5 (8), 1952 (29–33). [Russ.]

Measurements on *Quercus suber* plantations in the Sochi experimental forest in 1950–51 showed that the growth rate of the primary was only ½–⅓ that of the secondary cork layer. A stripping cycle of 5–6 years is suggested instead of the 9–12 years usually recommended [cf. *For. Abstr.* 10 (No. 2153)]; after the third stripping the cycle could, however, be extended by 1–2 years to produce thicker and higher-quality cork. Careful stripping does not affect the health or seed production of the tree. Macro- and microscopic studies suggest that the exposure and drying of the outer phellogen after stripping is accompanied by a flow of reserve nutrients from it to the inner layers, and their replacement by mineral substances; this process accounts for the subsequent hardness of the bark surface. Cambial cells in the outer, dying zone of the phellogen are killed, but those in the inner zone continue to divide and to form a new cork layer. The rapid growth of the secondary cork is explained by the use of nutrients withdrawn from the outer phellogen—but not of those stored in the phloem—for cell division and cork production, so that stripping does not interfere with the physiological processes in the organism as a whole. There is thus no point in prohibiting cork stripping from trees which are to serve for seed production.

4109. Kucubin and Ageev. Opyty po vyraščivaniju i uhodu za kuljturoĭ probkovogo duba. **[Experiments in raising and tending Cork Oak plantations.]** *Lesn. Hoz.* 5 (8), 1952 (33). [Russ.]

In the Sochi experimental forest, *Quercus suber* grafted on *Q. robur* appeared to be immune to a widespread 'ink-spot' disease. Experiments on 100 5- to 15-year-old *Q. suber* demonstrated the possibility of extending the cork-producing part of the stem by pruning the lower branches flush with the phloem during the rest period; by Aug.–Sept. the wounds are occluded, the new tissue producing a normal cork layer. This method increased the total cork-producing length of stem for 40 trees from 52 to 173 m. Pruning must be done at an

early age, when the branches are still small. Other experiments showed that stripped stems needed protection against exposure [type of covering not specified] in the first season after stripping, to prevent cracking and other defects which would render the cork of that season useless.

283. *Fruit and Seed Crops*

See also No. 3830.

4110. ZARUBIN, A. F. Vosstanovlenie i razvitie orehovo-plodovyh lesov Južnoï Kirgizii. **[The rehabilitation and development of the Walnut/fruit-tree woodlands of Southern Kirgizia.]** Institut Lesa, Akademija Nauk S.S.S.R., Moscow 1954. pp. 139. 45 refs. [Russ.]

Based on the author's studies, extending over nearly 20 years, with chapters on: regeneration by coppice; root systems of trees of seedling and coppice origin; regeneration fellings; selection of coppice shoots to grow on to tree size; planting and sowing; grafting; selection and breeding; grafting of Apple and *Prunus divaricata*; nursery practice; seed collection, storage and treatment; pests and diseases of Walnut and the associated fruit trees; utilization of Walnuts. Except where indicated, these chapters refer chiefly to Walnut (*Juglans regia*). An appendix suggests details of plantation establishment and organization for various local conditions.

4111. BREVIGLIERI, N. Indagini ed osservazioni sulle migliori varietà italiane di castagno (*Castanea sativa* Mill.). **[The best Italian varieties of Chestnut for nut production.]** *Pubbl. Cent. Stud. Castagno, Firenze* No. 2, 1955 (27–166). [It.it.f.e.g.]

284. *Crops Tapped for Exudations*

See also No. 3806.

4112. BOKOR, R., and LÁNYI, J. Gyantatermelésünk fokozása. **[The increase of our resin production.]** *Erdész. Tud. Int. Évk.* 41, 1951 (1953), (20–30). [Hu.russ.e.g.]

HCl at 25% doubled the resin yield but tended to damage the wood. $ZnCl_2$ at 10% proved an even better stimulation; $BaCl_2$ was also good but not fungicidal. Narrow, frequent streaks respond best. A rest from tapping of 1–2 weeks (end of June–early July) increases the total yield. Hungary has now been divided into 4 tapping regions, according to start and duration of tapping.

4113. GOMES, A. M. DE AZEVEDO. Sobre a influência da resinagem no crescimento do pinheiro bravo. I. Crescimento em diâmetro. **[The influence of resin tapping on increment of *Pinus pinaster*. I. Diameter increment.]** *Estud. Inform. Serv. flor. aqüic. Portugal* No. 43-*E* 3, 1954. [Port.] Limited distribution.

A statistical analysis is presented of data obtained from *Pinus pinaster* tapped over a period of 20 years versus untapped controls. The results show that tapping is responsible for a significant difference in diameter growth.

4114. BEDENKO, V. F. **[Technology of Pine tapping over 15 years.]** *Derev. lesohim. Prom.* 2 (2), 1953 (10–2). [Russ.] From *abstr.* in *Holzforschung, Berlin* 9 (3), 1955 (93). [G.] P.R.

According to the author's experience, tapping in the Krasnoyarsk region (Siberia) should begin in the 1st year at a height of 185 cm. and proceed downwards, whereas in the 2nd and 3rd year it should proceed upwards. For later years the author recommends a mixed method, viz. upward freshening during the 1st half of the tapping season, and downward during the 2nd half; this is said to increase the yield by 10%.

286. *Osier-Growing*

4115. BENINCASA, R. I boschi cedui di salice in Provincia di Parma. **[Osier growing in the province of Parma.]** *Monti e Boschi* 6 (3), 1955 (121–5). [It.f.e.]

More than 1000 ha. of osiers are grown on the banks of the Po in this province; their cultivation, yield and financial return are described.

3. WORK SCIENCE (WORK STUDIES). HARVESTING OF WOOD: LOGGING AND TRANSPORT. FOREST ENGINEERING

30. WORK SCIENCE (WORK STUDIES): GENERAL

See also No. 3710.

4116. WERNER, H., *et al.* Beiträge zur Technisierung der Forstwirtschaft. **[Technical rationalization of forest operations.]** Deutscher Bauernverlag, Berlin. 1953. pp. 175. [G.]

A symposium, with contributions by *H. Werner, G. Morgenroth, E. Scheuch, H. Achilles, C. Röbert, E. Hoffmann, G. Wasmund, F. Hache, K. Becher, A. Geyer,* and *W. Baak,* on rationalization in all branches of forestry in E. Germany, the individual papers dealing with the political background, work studies, labour relations, improvement of hand tools, mechanization, maintenance of tools and machines, etc.

302. *Man and Work (Physiology and Psychology)*

See No. 4048.

303. *Training in Work Science and Efficiency*

See No. 4851.

304. *Hygiene. Safety. Accidents and their Prevention*

4117. PETERSON, D. G. **Biology and control of biting flies in pulpwood cutting areas.** *Pulp Paper Mag. Can.* 56 (5), 1955 (180 . . . 186). 8 refs. (*Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1468 (B-2).)

Outlines the purpose and nature of a co-operative investigation in Quebec Province covering the biology, host preferences and control of black flies, mosquitoes, biting midges and tabanids. Control studies include aerial spraying, aerosol generators, barrier sprays, repellents and protective clothing.

305. *Sequence of Work and Performance (Time and Performance Tables, Evaluation of Work)*

See Nos. 4047, 4092.

307. *Tools, Equipment, Machines and Working Animals: General*

See also Nos. 3974, 3991, 4018, 4034, 4047, 4085–6, 4195–7, 4346.

4118. **New forestry equipment.** *Lumberm.* 82 (7), 1955 (72).

Describes briefly: a diesel-powdered portable chipper developed by Pilot Rock Lumber Co.; a pocket log-scaling tape and magnesium scaling stick; the Elkins scalometer, an electrical mechanical instrument for pulpwood volume determination; and the Haga altimeter, a portable instrument giving direct readings of tree height.

4119. **Equipment news.** *Unasylva* 9 (1), 1955 (39–41).

Descriptive notes, with photographs, of the following among others: the 'Spiegelrelascop' (Dr. Ing. Walter Bitterlich, Salzburg, Austria) [cf. *For. Abstr.* 14 (No. 1394)]; 'Jätkä 1' disc-type pulpwood barker (Aug. Eklof AB, Borgas, Finland); barking machine with 10-h.p. diesel engine (J. R. Gordon & Co., Chester, England); Whitmore timber arch for extracting poles, thinnings etc. (Reginald Tildesley Ltd., Willenhall, Staffs., England); Skoglund Model M 12 barker (A B Gävle Varv, Gävle, Sweden); tilting fork attachment for 'Tracto-Lift' fork trucks for handling logs (Tracto-Lift Co., Kansas City); 'Mudmaster' detachable crawler tracks for every type of vehicle (Bates Brothers Ltd., Rugby, England); the 'Landtainer' attachment for the conversion of wheel tractors of 35–55 h.p. into motor graders (Landsborough Findlay Ltd., Johannesburg, S. Africa).

4120. Ilon, B. Teknik i skogen 1955. [**Technical developments in forestry, 1955.**] *Skogen* 42 (7), 1955 (139–41). [Sw.]

Describes briefly equipment (much of it Swedish) shown at a forestry exhibition in Stockholm, e.g. barkers, horse sledges, loading equipment, tractors and saws.

31. LOGGING AND TRANSPORT: GENERAL

See also Nos. 3945, 4437, 4442.

4121. Huber, A. **Mountain timber extraction.** *Unasylva* 9 (1), 1955 (14–9). 2 refs.

Discusses the general problems of timber extraction in mountainous country, with illustrative details from India and Jugoslavia.

4122. Allouard, P. L'exploitation Corre Frères à Agboville (Côte d'Ivoire). [**The forest operations of Corre Frères at Agboville (Ivory Coast).**] *Bois For. Trop.* No. 40, 1955 (17–29). [F.f.e.span.]

Gives a detailed account (with photographs) of the use of a tripod crane ('grue à béquilles') designed for loading trucks on the landing site; the portal cranes used for loading railway wagons; and the use of a heavy metal bar dragged obliquely behind a wheeled tractor to roughly level forest roads.

4123. Raad, A. L'exploitation forestière Agrifor au Congo Belge. ['**Agrifor': forest exploitation in the Belgian Congo.**] *Bois For. Trop.* No. 41, 1955 (27–41). [F.]

The Société Agrifor works an area of ca. 400,000 ha. from which it extracts principally Agba (*Gossweilerodendron balsamiferum*) and Limba (*Terminalia superba*). Production is 60–80 thousand cu.m./year, which is obtained with 14 D.7 or D.8 tractors and 38 vehicles of different types. Tabulated data are given for performance, production and costs of tractors for road-making and timber extraction.

4124. Petriceks, J. **The present state of forest exploitation in Venezuela.** *Emp. For. J.* 34 (1), 1955 (64–7 + 6 photos).

32. FELLING AND RELATED OPERATIONS

321. *Marking*

4125. Polycarpou, A. **Rules for marking in the *P[inus] brutia* forests of Cyprus.** *Tech. Pamphl. For. Dep. Cyprus* No. 12 (rev.) 1954. pp. 14 + form + 5 diagrams. 4 refs.

322. *Felling Season. Preparatory Measures*

See also Nos. 4675, 4699.

4126. Cymek, A. A. Splav listvennicy i listvennyh porod na Daljnem Vostoke. [**Floating of Larch and broadleaved species in the Far East.**] *Lesn. Prom.* 14 (10), 1954 (27–9). [Russ.] P.O.

The workers of the Soviet Far-Eastern Forest Research Institute found that a simple and efficient method of reducing the proportion of sunk Larch logs is to make cuts at least 1 cm. deep into the heartwood of standing Larch; this causes the wood to be pre-dried, with consequent decrease in density (from 1·032 to 0·920 in the butt, and from 0·885 to 0·720 in the central and top part of the stem). While middle-portion and top logs thus acquire sufficient buoyancy, the butt logs must be barked and air-dried in low stacks. It was found that the % of sunk butt logs fell to 0·33 compared with 24·2 without pre-drying. Similar reductions in loss were effected with *Betula platyphylla, B. mandschurica, Acer mono, A. mandschuricum* and Aspen [*Populus tremula?*] but not with *Fraxinus mandschurica.*

4127. Wilcox, H. **Preliminary study of the penetration of sodium arsenite and sodium monochloracetate solutions into trunks of Yellow Birch and Red Spruce.** *Bot. Gaz.* 116 (1), 1954 (73–81). 2 refs. O.B.D.

Red Spruce [*Picea rubens*]: The absorption of either chemical through the exposed surface of the sapwood tended to decrease with time towards an

equilibrium value, which took ca. 5 days. In addition, there was a diurnal fluctuation, with a slower rate occurring during late evening and early morning. Both chemicals showed an inverse relationship between absorption and concentration. The tested concentrations of Na arsenite penetrated more slowly than corresponding concentrations of Na monochloroacetate. Acid solutions of the latter were taken up faster than alkaline solutions. There was a sharp rise to maximum absorption on 4 June, followed by a rapid decrease from mid-June through mid-July, with another peak in late July and early August. Yellow Birch [*Betula lutea*]: No absorption of either solution was observed until after the cessation of bleeding, which occurred abruptly on 26 May, when the leaves were half expanded. The absorption of chemicals did not occur so readily as in Spruce. High concentrations of treating chemicals resulted in a net outward movement of water from the tree. *From author's summary.*

323. *Felling and Subsequent Primary Conversion*

See also Nos. 4132–40, 4548.

4128. Siriban, F. **Protecting Narra logs from wasteful cutting.** *Filipino For.* 5, 1953 (50–5). 2 refs.

Narra (*Pterocarpus indicus* and *P. vidalianus*) trees have pronounced buttresses and irregular fluted stems. It is customary to square the logs in the forest, and investigation showed that the annual loss of wood left in the forests of the Philippines due to squaring is ca. 3348 cu.m. or 40% of the total production. It is recommended that round logs should be extracted (including the buttress) and all conversion done at the mill.

33. DEGREE OF UTILIZATION AND WASTE. CLEARING THE FELLING SITE. HARVESTING OF SMALL WOOD

See also Nos. 4128, 4191, 4434, 4780–1, 4788.

4129. Doyle, J. A. **Logging waste in Eastern Canada.** *Bull. For. Br. Can.* No. 115, 1954. pp. 24.

The first of a series of studies by the Forest Products Laboratories of Canada to determine the character and volume of usable wood left on logged areas in various parts of Canada. The principal sources of waste are: (1) high stumps, (2) long butts (the practice of cutting a bolt from the end of a log to eliminate defect), (3) large tops, and (4) uncut defective trees of merchantable diameter. It was found that (1) accounted for 2% of original merchantable volume of stands, (2) for 1·8%, (3) for 12·8% and (4) for 2·1%.

4130. Doyle, J. A. **Study of logging waste in Saskatchewan Spruce operations.** *Repr.* from *Canada Lumberman* [*Toronto*] Aug., 1954. pp. 5. 2 refs. P.R.

While varying considerably from one operation to another, the waste in Spruce sawlog operations in Saskatchewan was 5%, compared with nearly 13% found in Eastern Canada. This difference is chiefly due to the relatively smaller % of waste left in the form of top material in Saskatchewan where tree-length logging is much more common than in Eastern Canada. *From author's summary.*

4131. Yamazaki, F., Yawata, T., *et al.* **Research on stump pulling (third to sixth reports).** *Journal, Agricultural Engineering Society of Japan, Tokyo* 21, 1954 (75–101; 369–79); 22, 1954 (1–14). [Jap.?] From *abstr.* in *Rec. Res. Fac. Agric. Univ. Tokyo* No. 4, 1955 (41–4). [E.]

(3) Results on Japanese Larch showed that it is more resistant to uprooting by pulling than *Chamaecyparis obtusa* or *Pinus densiflora.* Its roots are slow to decay, and resistance is very little reduced after several years. Formulae are given showing the relationship of tractive resistance and diameter 1, 5 and 10 years after felling. Recommendations are made on methods for uprooting stumps 10, 15–20 and 20–25 cm. in diameter. (4) Burning tests were made on logs 30 cm. long of *P. densiflora, Quercus crispula,* Chestnut, Cherry, *Cryptomeria japonica, Fagus crenata* and *Magnolia obovata.* Holes 24 mm. in diameter were drilled vertically and horizontally in the logs, using a ½-h.p. electric drill. Difficulty in drilling increased in the order: *P. densiflora, C. japonica, M. obovata,* Chestnut, Cherry, *F. crenata, Q. crispula.* Drilling was easier in the more difficult trees if a drill of smaller diameter was used first. Paraffin and Pine resin were found to be suitable ignition agents. *Q. crispula* was the most difficult and *P. densiflora* the easiest to ignite. Ignition is influenced by the direction of drilling; illustrations show satisfactory arrangements of drill-holes. The relation of combustion to wind velocity, species, and direction of drilling was also tested. (5) Questionnaires on methods of removing stumps were sent to 376 settlers on reclaimed lands, and results showing methods in different regions have been classified. (6) In tests on the use of explosives (dynamite and carlit) holes were bored with a ¾-h.p. electric drill. For stumps with a large taproot, e.g. *P. densiflora,* holes are bored in the taproot and after the explosion the lateral roots can be cut by hand and the stump removed. For those with many lateral roots, e.g. *Q. crispula,* holes are made in the stump near ground level and the pieces of stump are easily removed after the explosion. Suitable amounts of explosive for *P. densiflora* several years after felling were 45 g. for a 30-cm. and 90 g. for a 50-cm. stump. The cost is ½ to ¾ that of the method used so far, in which the explosive is placed in the soil under the stump. [Cf. *For. Abstr.* 14 (No. 1240).]

34. STORAGE IN THE FOREST AND AT LOG DUMPS

See Nos. 4548, 4714.

35. PERFORMANCE MEASUREMENTS FOR DETERMINING PIECE RATES IN FELLING AND RELATED OPERATIONS

4132. Maliniemi, E. Tilastollinen tutkimus sahapuiden hakkuusta ja ajosta Perä-Pohjolassa. **[Statistical investigation into the felling and transport of sawlogs in the far north of Finland.]** *Silva fenn.* No. 82, 1953. pp. 27. [Fi.e.]

The following factors were investigated and the results (set out in graphs and tables with English legends) analysed statistically: (1) the distribution of the material into stem classes; (2) the effect of average stem volume on daily felling and hauling output; (3) average amount of daily haul over varying distances; (4) effect of density of the stand marked for cutting on felling and hauling output; (5) effect of % of top logs on felling output; (6) best size of work team (hauliers and fellers) for different hauling distances (the ideal team for 0–2·5 km., was found to be 1 + 3). It is claimed that (5) and (6) have not previously been investigated.

4133. MAKKONEN, O. **Working time and wages for the preparation of small diameter pulpwood.** *Finnish Paper & Timber, Helsinki* 6 (3), (37–8). [E.]

A shortened version in English of an article that has already appeared in Finnish [see *For. Abstr.* 16 (No. 1813)].

36. TOOLS, MACHINES AND EQUIPMENT FOR FELLING AND RELATED OPERATIONS

See also Nos. 4116, 4118–20, 4131, 4548.

4134. **'Kingslaw' debarker.** *Timb. Tr. J.* 213 (4109), 1955 (64).

The barker is constructed as a 23-cwt., 2-wheel trailer on tubeless tyres with a 4-jack working stance, and is easily manhandled from pile to pile. It is driven by an air-cooled 10 h.p. diesel engine with a powerful fan extractor, and can deal with pitprops 2½—8 in. diam., of any length, up to 40 ft./min., and easily maintains 1500 ft./hr., which is faster than it can be supplied by the best cross-cut teams. Barking is reported as exceptionally clean, with knots close-trimmed. The cost is £1,175.

4135. **'Carpenter' debarker.** *Timb. Tr. J.* 213 (4099), 1955 (117).

Describes, with a photograph, the 'Carpenter', manufactured by the Soderhamn Machine Manufacturing Company, Alabama, U.S.A. It weighs 3500 lb. and can be pulled by a car or lorry. The bark is removed by abrasion from sections of chain bolted to a shaft mounted on self-aligning ball bearings and driven by 2 vee-belts. It has been successfully used on pulpwood diameters of 4–16 in. A crew of 3 is needed. The logs are fed in and out on ribbed rollers.

4136. SALMINEN, J. **On barking at an intermediate storage [site] with a portable continuous-feed barking machine.** *Pap. ja Puu* 37 (4*a*), 1955 (150–6). [E.] P.R.

English version of an article already published in Finnish. [See *For. Abstr.* 16 (No. 3062).]

4137. Szász, T. Fontosabb hazai fafajokon végzett erdeifürész kísérletek eredményei. **[Experiments with felling-saws on the most important native trees.]** *Erdész. Tud. Int. Évk.* 1, 1951 (1953), (165–79). [Hu.russ.e.g.]

The output and energy consumption of various handsaws of indigenous make and different tooth patterns are compared in tables and graphs for Poplar, Pine, Beech, *Quercus robur* and *Q. cerris*, as also the savings resulting from correct professional sharpening (now compulsory).

4138. VORONICYN, K. I., and MAKOVEEV, P. D. Diskovaja sučkorezka 'Sever'. **[The 'Sever' circular branch-trimming saw.]** *Lesn. Prom.* 14 (12), 1954 (6–9 + 4 photos). [Russ.] P.O.

Illustrated description of the design and operation of the SA-18 ('Sever') circular trimming saw developed in Archangel after 6 years' work. Driven by a 3-phase, 1-KW. motor, weighing ca. 6 kg., its 23-cm.-diam. saw blade cuts 70–80 sq. cm./sec. and can deal with branch diameters of 17 cm. The merits of the 7 prototypes now tested are discussed.

4139. AKIMOV, A. I., and UVAROV, N. V. Benzinomotornaja pila 'Družba'. **[The 'Družba' petrol-engine saw.]** *Lesn. Prom.* 14 (10), 1954 (7–9). [Russ.] P.O.

Illustrated description and appraisal of this recently designed and tested one-man chain saw (weight 10·5 kg., working length 44 cm., kerf 7·5–8 mm., engine with a 2-stroke single cylinder of 94 c.c., sawing speed 4·5 m./sec.) which can be used for both felling and cross-cutting.

37. TRANSPORT

372/377. *Land Transport*

See also Nos. 4119–20, 4122–3, 4132, 4728.

4140. REŠETOV, A. V. Podvozka lesa v Timirjazevskom lespromhoze. **[Log transport in the Timiryazev Lespromkhoz.]** *Lesn. Prom.* 14 (10), 1954 (10–3). [Russ.] P.O.

A photo time study in June 1954 showed that less time is spent when tree-length logs complete with crowns are skidded butt-end first than in the skidding of crownless logs top-end first. A new design of tractor is, however, needed.

4141. KATO, S. **On the reliability of the theory of the parabolic cable applied for the calculation of the skyline logging cables.** *Trans. 62nd Mtg. Jap. For. Soc.* 1953 (183–5). [Jap.?] From *abstr.* in *Rec. Res. Fac. Agric. Univ. Tokyo* No. 4, 1955 (75–6). [E.]

New theoretical formulae [not given in the abstract] modifying the ordinary formulae for the parabolic cable, were derived by the author and found reliable in practical experiments.

4142. BENNETT, W. D. **Cable yarding developments in Eastern Canada.** *Pulp Paper Mag. Can.* 56 (5), 1955 (169 . . . 177). (*Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1466 (*B*-8-*g*).)

Covers the extension and present use of cable yarding, 90% of which deals with bundled 8-ft. pulpwood. Equipment improvement, production, costs, suitable terrain and density of stocking, layout of strip roads and labour training are discussed.

4143. TENNAS, M. E., RUTH, R. H., and BERNTSEN, C. M. **An analysis of production and costs in high-lead yarding.** *Res. Pap. Pacif. Nthwest. For. Range Exp. Sta.* No. 11, 1955. pp. 37. 6 refs.

Factors influencing production and costs in an operation in a 100-year-old [conifer] stand on the Cascade Experimental Forest were isolated and

analysed. Industrial engineering techniques and statistical analyses were used to estimate the effect of crew size, haul-in distance, volume per turn, slope, length of yarding road, and number of logs/acre, on production and costs, results being shown in graphs. Formulae and tables for estimating production rates for various combinations of factors and examples of their use for similar equipment and conditions are given. The effects of different variables on the phases of the operation are discussed. *From authors' summary.*

4144. **Two types of power winch.** *Equipm. Note, FAO* No. C.6.54, 1954. pp. 2.

Specifications and operating costs of (1) a portable winch designed by the Forestry Commission, Great Britain and (2) a self-propelled (crawler), high-drum-capacity winch, manufactured by W. Keller & Co., Berne.

4145. KONJUHOV, K. P. Kolesnyĭ pricep na lyžah. [**Wheel trailer on runners.**] *Lesn. Prom.* 14 (9), 1954 (20–1). [Russ.] P.O.

Illustrated description of a two-wheel trailer in which rubber tyres are replaced by 150-cm.-long ski runners secured to the wheel by 2 tension members and 3 bolts; this reduces the weight of the trailer by ca. 100 kg.

4146. FUJIBAYASHI, M., KATO, S., MARUYAMA, M., and HAYASHI, M. **An all-season tractor-truck, designed and tested.** *Trans. 62nd Mtg. Jap. For. Soc.* 1953 (189–90). [Jap.?] From *abstr.* in *Rec. Res. Fac. Agric. Univ. Tokyo* No. 4, 1955 (76). [E.]

The vehicle is designed for use on snowy roads in winter and normally as a lorry in summer. A small 3-wheeled commercial vehicle served as the basis, the front wheel being replaced by a sledge and the rear axle and wheels by special driving devices and crawler tracks. The principles of the design and test results [not given in the abstract] are reported.

4147. HOLEKAMP, J. A. **Hammermill's new technique of pulpwood transport in gondola cars.** *Paper Tr. J.* 139 (11), 1955 (28–9). P.R.

A summary from *American Pulpwood Association Release* No. 215. The inside of most railway wagons of this type now in service for this mill is 9 ft. 6 in. wide × 52 ft. 6 in. long. Upright bolts safely contain 50-in. pulpwood piled to a height of 5 ft. 4 in. in standard gondola-type railway wagons.

378. *Water Transport*

See also No. 4126.

4148. PE KIN, U. **The Kado timber depot.** *Burmese For.* 4 (2), 1954 (88–95) [E.]

Describes the lay-out and operation of this large depot, 6 miles upstream from Moulmein on the Salween River, where thousands of logs per annum are sorted, classified, and assessed for customs.

4149. **[Floating in British Columbia.]** *B. C. Lumberm.* 39 (4), 1955 (40 . . . 57).

Four illustrated articles covering driving and rafting on the Fraser Canyon and Spillimacheen (upper Columbia) rivers, boom insurance, and a co-operative service for salvaging beach-stranded logs.

4150. KARLQVIST, S., and STRINDBERG, J. Sjunkningsfri timmerintagning vid Östrands fabrike i Timrå. [**Getting timber from the water without sinking at the Östrand mill, Timrå.**] *Svensk Papp. Tidn.* 58 (7), 1955 (229–33). [Sw.] P.R.

Timber, either loose or bundled, is removed from the terminal floating basin by a grab mounted on a crane, at a maximum rate, so far, of 51,000 logs/24 hours. The grab is also used to salvage sunken timber and chains from the basin. The grab in use and the lay-out of the basin and mill are shown in photographs and diagrams.

4151. VIRSUNEN, U. **Bundling methods.** *Pulp Paper Mag. Can.* 56 (4), 1955 (122 . . . 128). 4 refs.

Describes, with illustrations, land and water bundling machines, gives the standard sizes for hardwood, softwood and pulpwood bundles in Finland and specifications for binding materials, and lists 7 advantages over loose driving. Methods of making up bundle rafts are illustrated. The elimination of loss by sinking (Spruces 2–5, Balsam Fir 7 and Jack Pine 4% by volume) is the most telling advantage.

4152. MOSEVIČ, P. I. Mehanizacija zimne splotki lesa. [**Mechanization of winter rafting.**] *Lesn. Prom.* 14 (10), 1954 (22–6). [Russ.] P.O.

Describes and illustrates a new method of bundling logs during winter, used successfully in 1953–54 in the Kamlesosplav 'Trust'. Logs are unloaded at the cross-cutting point, trimmed and rolled on to a sorter-elevator which conveys them to points where they are thrown into a bundling apparatus. The sorter-elevators, 2·6 m. high,are mounted on railway flats. The bundling apparatus consists of a wooden foundation with movable iron standard supports, iron chains being used for struts.

4153. BUTYRSKIĬ, JU. N. Splav listvennogo les bez hvoĭnogo podplava. [**Floating of timber of broadleaved species without coniferous floats.**] *Lesn. Prom.* 14 (10), 1954 (29–30). [Russ.] P.O.

Much *Populus nigra* and *Salix alba* was floated in 1954 over a distance of ca. 1500 km. on the Volga without using softwood floats. The buoyancy of bundles made of these species is the greater, the longer the logs and the higher the proportion of large diameters, the basic condition being the presence of bark.

4154. KEYS, G. T. **Log length and boom strain.** *Pulp Paper Mag. Can.* 56 (3), 1955 (304 . . . 309). (*Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 1466 (*B*-9-9).)

Scale tests (20/1), carried out in a glass-sided flume simulating conditions at the Matane River holding ground, showed that the forces to be expected in driving 4-ft. wood would be no greater, and perhaps less, than with a mixture of 12- and 16-ft. logs. With velocities as high as 4·2 ft./sec., the boom fence should be 5 ft. deep to contain the wood, and precautions are necessary to prevent it rolling.

4155. CHOPRA, R. S. **The design of a timber boom at Dehra Gopipur on the Beas.** *Indian For.* 81 (5), 1955 (331–41).

The design and specification of a V-shaped two-way timber boom are described, and the basic calculations involved in the design are discussed.

4156. **Something new in pulp log towing.** *Paper Tr. J.* 139 (15), 1955 (27–8). P.R.

Describes a new log-carrying barge, 342·8 ft. long, with a 63-ft. beam, capable of carrying as large a load as is assembled in a normal Davis raft. For unloading, four 8-in. valves are opened, allowing sea water to flood two tanks along the port side of the barge, so that logs slide into the water under their own gravity. The valves are then reversed, the tanks emptied, and the barge returns to normal equilibrium.

38. FOREST ENGINEERING

4157. LIDSTRÖM, B. Motorbergborrmaskiner och luftkompressorer för skogsbrukets behov. **[Power rock drills and air compressors for forestry.]** *Meddelande, Föreningen Skogsarbetens och Kungl. Domänstyrelsens Arbetsstudieavdelning . (S.D.A.), Stockholm* No. 50, 1954. pp. 18. [Sw.e.] (*Repr.* from *Maskinteknik i Jord och Skog* 1954 (1–3).)

381. *Materials (including Explosives and their Use)*

See also No. 4131.

4158. EASTERLY, E. G. **How to use explosives.** *Lumberm.* 82 (6), 1955 (60–2).

Discusses the use of delay electric blasting caps, which have delay elements measured in thousandths of a second, for quarrying and road construction.

383. *Roads and Bridges*

See also Nos. 4119, 4122–3, 4157–8.

4159. SAARINEN, V. A. Uudet metsäautoteiden normaalipiirustukset laadittu metsähallituksen toimesta. **[New standards by the Forest Service for forest truck roads.]** *Metsät. Aikak.* 1955 (5), (165–7). [Fi.e.]

Standards [not described in the English summary] have been adopted by the Finnish Forest Service for two types of road, both of which can be developed gradually, first as winter truck roads, then as general supply roads, and finally as year-round timber haulage roads. The Forest Service plans to construct 3400 km. of fast truck roads in state forests. [Cross-sectional diagrams of the roads are given with Finnish captions.] *From author's summary.*

4160. ILJIN, B. A. Usilenie proezžeĭ časti dorog pri vyvozke lesa avtomobiljami tjaželogo tipa. **[Strengthening the load-carrying part of roads for timber transport by heavy lorries.]** *Lesn. Prom.* 14 (11), 1954 (6–9). [Russ.] P.O.

With the introduction of heavier lorries (e.g. MAZ-200 with 7-ton loading capacity, 10·12 tons load on rear axle, and 6 kg./sq. cm. ground pressure on rear tyres, compared with 3 tons, 4·8 tons and 4·5 kg./sq. cm. for ZIS-5), gravel-surfaced roads must have a thicker surface. For log roads a 'herringbone' structure was suggested as early as 1939 and gave good results. A sectional road constructed of light-weight reinforced-concrete panels (250 × 100 × 16 cm.) has been used in the Leningrad region for some time; 220 tons of concrete and 24 tons of steel are required for 1 km. of road. The panels have oval vents wider at the bottom than at the top, to allow a firm bed.

4161. **Soil stability on forest lands.** *Rep. Intermt. For. Range Exp. Sta. 1954*, 1955 (32–3).

Gives observations from the Boise National Forest on the occurrence of gully erosion on haul roads for different gradients and the maximum spacings of cross ditches, etc., to prevent erosion for different gradients of road and skid trails.

4162. ISTOMIN, G. V. Opyt stroiteljstva ležnevyh ščitovyh dorog dlja avtomobileĭ MAZ-501. **[Experience gained in the construction of cant-log roads for MAZ-501 lorries.]** *Lesn. Prom.* 14 (11), 1954 (9–12). [Russ.] P.O.

Illustrated description of the construction of roads made from 5-log assemblies of 650 × 120 × 14 cm. (softwood cants of 2nd or 3rd grade).

4163. TUFFIER, M. **Graders now available on the world market.** *Equipm. Note, FAO* No. *B.*4.54, 1954. pp. 9. Transl. from *Bois For. Trop.* No. 35, 1954 (33–51). [See *For. Abstr.* 15 (No. 3668).]

4164. HARRISON, J. L. **The lay-out and construction of forest roads.** *Emp. For. Rev.* 34 (1), 1955 (42–8).

Puts forward arguments against any heavy initial expense on lay-out and construction, and in favour of an initial low standard of construction, the grade of road being improved later as circumstances warrant; and emphasizes the possibilities of earth roads. Such roads, made from the natural soil in the various localities, have had to stand up to quite heavy traffic in severe climatic conditions in various parts of the world. In discussing the construction and maintenance of earth roads, stress is laid on the necessity for an adequate drainage scheme for the sub-grade, for the road-base, and for the road surface itself. To obtain optimum results, the road-base must be well consolidated, preferably by rolling, the road must be given an ample camber, and its surface must be made as long-wearing and waterproof as funds and local conditions permit. *From author's summary.*

385. *Drainage, Irrigation, Sedimentation. Water Supply*

4165. YLI-VAKKURI, P. Aikatutkimuksia metsäojitusten kivitöistä. **[Time studies on stone work in connexion with forest drainage.]** *Silva fenn.* No. 84, 1954. pp. 17. [Fi.g.]

In addition to the usual subjects of a work study (proportion of idle time etc.) the effect of stone size on working time was investigated. Illustrations, table etc. have German legends.

4. FOREST INJURIES AND PROTECTION

See also Nos. 3857, 3945, 4110.

41. GENERAL TECHNIQUE OF FOREST PROTECTION. TYPES OF INJURY

411. *Natural and Biological Control*

See Nos. 4203–4, 4215, 4235–6, 4288–91, 4303, 4308, 4314, 4318–9, 4322–4, 4326, 4333, 4339, 4349–51, 4353.

413. *Physical and Mechanical Control (Trapping etc.)*

See No. 4250.

414. *Chemical Control*

See also Nos. 4011, 4186–8, 4250, 4293–4300, 4305, 4335–6, 4346.

4166. VOIGT, G. K. **The effect of fungicides, herbicides and insecticides on the accumulation of phosphorus by *Pinus radiata* as determined by the use of P^{32}.** *Agronomy Journal, Madison* 46 (11), 1954 (511–3). 8 refs. E.M.B.

The effects of the chemicals were tested on seedlings and root tissues. The results indicated that some of the agents inhibited the absorption of P and arrested the development of the seedlings. This was particularly noticeable in the case of $Al_2(SO_4)_3$, Thiosan and BHC. Allyl alcohol and formaldehyde caused increased absorption of applied P, and stimulated growth of seedlings. Determinations of O uptake and P content of excised root tips and mycorrhizal short roots showed that reduction of P accumulation, as indicated by the relative content of P^{32} and the content of total P in the tissues, was accompanied by a decrease in the rate of O consumption. This response occurred within a relatively short time after the tissues had been exposed to the biocides, and was especially marked in the case of Thiosan and BHC. The results of the study point out the importance of obtaining uniform distribution of biocides in the soil as well as using the proper rate of application, if injury to planting stock is to be avoided. *From author's summary.*

42. INJURIES FROM INORGANIC AGENCIES OTHER THAN FIRE

421. *Air Currents*

See also Nos. 4334, 4394.

4167. INOUE, K., and MASUDA, H. **[Storm damages to the national forest in Hokkaido.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (108–20). 8 refs. [Jap.jap.e.]

Reports, with meteorological charts and tables, lists of areas and amounts of wood destroyed, the damage done by the extra-tropical cyclone, of 10 Mar. 1954, the severest recorded in Japan. Damage amounted to 4,400,000 *koku* of wood, $\frac{3}{4}$ being coniferous, mainly distributed on the lee side of the mountains. The presence of the shallow-rooted *Picea jezoensis* renders the Hokkaido forests more susceptible to storm damage than those of Honshu.

4168. STEPHENS, E. P. **Research in the biological aspects of forest production.** *J. For.* 53 (3), 1955 (183–6).

Contains details of the method of recording and mapping (10 ft. : 1 in.; vertical interval 6 in.) with which the history since 1730 is being reconstructed of ca. one acre of the Harvard forest at Petersham, Mass., together with some notes on the evidence of damage by storms (wind and glaze) and the effects of these on log-length, the micro-relief and soil (pitting and mounding).

4169. GRISEZ, T. J. **1954 hurricane damage on Penobscot experiment forest.** *J. For.* 53 (3), 1955 (207).

Notes on loss by volume and number of trees in Red and White Spruce/Balsam Fir/Hemlock in relation to diam., cutting practice and butt rot.

4170. DILLER, O. D., and MUCKLEY, H. R. **Wind damage in the Secrest Arboretum.** *For. Mimeo. Ohio agric. Exp. Sta.* No. 20, 1955. pp. 2.

A short note on windthrow caused by a gale in March 1955. There are indications that the very conservative thinning policy pursued in the past may have made the plantations more susceptible to windthrow.

4171. DILLER, O. D., and DEAN, F. W. **Wind damage in a row-thinned Austrian Pine plot.** *For. Mimeo. Ohio agric. Exp. Sta.* No. 21, 1955. pp. 1.

Short note on serious damage in a gale (March 1955) on an 18-year-old, 1-acre plot of Austrian Pine, row-thinned in Nov. 1954, and selectively thinned to 172 trees/acre and pruned in Jan. 1955. The gale uprooted 90% of these trees while an adjacent plot that had been row-thinned only, showed no damage.

4172. **Wind damage [to Pine].** *Sta. Pap. Stheast. For. Exp. Sta.* No. 50, 1955 (28–9). (*Rep. Stheast. For. Exp. Sta. 1954.*)

A study of damage on the Bigwoods Experimental Forest in N. Carolina after Hurricane Hazel (Oct. 1954), showed that the greatest damage occurred in areas with scattered large seedbearers, where volume loss was 50%. Two uncut stands lost 9%, and 13 selection-system compartments only 4% of their volume. Severity of damage was directly correlated with the average size of seed trees retained and the extent of exposed edges of the stand.

422. *Temperature Influences. Frost. Heat. Drought*

See also Nos. 3726, 4041.

4173. MURRAY, J. S. **An exceptional frost in East Anglia.** *Quart. J. For.* 49 (2), 1955 (120–5 + 1 photo).

On 30 June 1954, 10° of ground frost were recorded at Thetford and varying intensities of radiation frost were experienced in Norfolk and Suffolk. Many species of forest trees were injured, but the damage was confined to nurseries and young plantations.

4174. WILNER, J. **Factors affecting winter injury of certain woody plants.** *Progr. Rep. Dom. For. Nursery Sta. Sask. 1954*, [1955]. (80).

Exploratory studies were conducted at Indian Head Forest Nursery Station to determine the reliability of the electrical conductivity method as a test for winter hardiness. Results indicated that electrical conductivity readings for injury of Apple twigs compared favourably with readings obtained by examinations of tissues and rating of growth of buds; the electrolyte test was found to be very consistent and to save much time. Electrical-conductivity readings of the solutions from 18 varieties of Apple twigs gave a fairly good estimate of the general field performance of these varieties during the winter, and similar results were obtained with 12 varieties of Plum and 20 varieties of Raspberry. Further intensive work is planned, to improve this method as a general criterion of the hardiness of woody plants commonly grown on the Canadian prairies.

4175. MAGNANI, G. Danni da freddo degli eucalitti. **[Winter injury to Eucalypts.]** *Cellulosa e Carta* 6 (4), 1955 (3–7). [It.f.e.]

The effect of low temperatures in Jan.–Feb. 1954 on 32 species of Eucalypt in nursery beds or cold frames is discussed and data are tabulated. *E. globulus* was the only open-grown species that did not suffer loss of the growing point; but, like the others, it suffered a good deal of leaf damage. Recovery varied: *E. corynocalyx*, *E. cornuta*, *E. pilularis* and *E. citriodora* all died; *E. grandis* suffered 78% mortality, *E. nigra* 60%, *E. polyanthemos* 20%. Other species recovered. Observation of adult trees of *E. rostrata*, *E. globulus E. viminalis*, *E. trabuti* and *E. resinifera* showed some injury to foliage and growing points, but all appeared to recover.

4176. ROSLJAKOV, T. G. Kuljtivirovanie èvkaliptov v Moldavii. **[The cultivation of Eucalypts in Moldavia.]** *Lesn. Hoz.* 5 (9), 1952 (22–5). [Russ.]

Includes special reference to a method for protecting *Eucalyptus viminalis* seedlings against winter cold, found to be the most effective of those tried in the winter of 1950–51, when minimum air temperatures dropped to — 19·3° C., and at ground level to — 26·7° on bare ground, which was frozen down to 31 cm. The method consists in making a mound of sawdust 25–35 cm. high round the stem, which is previously wrapped in 3 or 4 thicknesses of strong paper, and covering the sawdust with a 25–35 cm. layer of earth, thus forming a conical mound 50–70 cm. high and 60–80 cm. basal diameter. The plants were unwrapped at the end of March and assessments of frost damage made in April after the buds had started flushing; survival was 84·5% in one plot and 52·9% in another, while in a third, all plants had perished despite the protection. Actually, only 5–10 cm. of the protected portion remained undamaged by frost on the former, and 3–5 cm. on the latter plot. The tests show that although there are as yet no frost-hardy varieties, Eucalypts can, with such winter protection, be cultivated as a coppice crop, the foliage being utilized for the production of essential oils, tannins and drugs.

4177. COPELAND, O. L., JR. **The effects of an artificially induced drought on Shortleaf Pine.** *J. For.* 53 (4), 1955 (262–4). 3 refs.

A soil area of 26 × 62 ft., containing 6 Pine trees, was stinted of moisture by a 30-in.-deep peripheral trench and a waterproof cover. Turpentine beetles attacked 3 trees the same year and these died the next year. In the other 3 trees, diam. growth ceased, and shoot-growth, length of shoots with persisting needles, and needle length, were all drastically curtailed. The uptake of N remained normal but totals decreased with the reduced weight of foliage. Branch dying proceeded upwards, leaving a half-sized crown with reduced foliage tufts. This form of crown reduction, the absence of chlorosis and the maintenance of N uptake, separate these symptoms from those of the littleleaf disease and would seem to preclude drought as a precursor of that disease.

4178. LEMPS, F. DE. Dépérissement du hêtre et pluviosité sur le plateau de Langres. **[Die-back of Beech and precipitation on the plateau of Langres.]** *Bull. Soc. for. Franche-Comté* 28 (5), 1955 (241–8). [F.]

The die-back is confined to areas with shallow, permeable soils, and drought was the suspected cause. Data from a meteorological station adjacent to one of these areas showed a gross deficit in precipitation of 6% for the 10 years 1945–54, compared with mean precipitation for the previous 90 years. When the figures were broken down by seasons and expressed graphically to show 'pluviosity' by rectangles with one side representing number of days of rain and the other mean precipitation/day of rain [cf. *For. Abstr.* 15 (No. 3832)] it was apparent that 7 out of 10 'vegetative years' (autumn, winter, spring, summer) were deficient, compared with the mean for 90 years, and 3 years (1945, 1948, and 1951) were very excessive. Calculation of the index of aridity ($I = \frac{P}{T + 10}$ where P = total annual precipitation and T = mean annual temperature) gave a value of 37·0 for the 10-year period compared with 39·9 for the mean. It is considered proved that these climatic conditions are responsible for the die-back of Beech, the excess rain in the rainy periods not compensating for the long periods of deficit on soils with poor storage capacity.

423. *Precipitations*

See also No. 4168.

4179. INOUE, K., and MASUDA, H. **[Glaze damage to forest stands in Kamikawa Basin.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (97–107). 7 refs. [Jap. jap. e.]

Describes, with photographs, meteorological charts, and tables, glaze damage associated with a warm front. Plantations of *Cryptomeria japonica* and *Larix leptolepis* are easily damaged. To avoid this, suitable thinning and pruning and the maintenance of healthy growth are essential, but excessive thinning intensifies the glaze danger. The damage has been reported north of lat. 35° N. in Japan, Germany, France, and Illinois, U.S.A.

4180. JUUTINEN, P. Männyn toipuminen Kolilla talven 1947–48 lumituhojen jälkeen. **[The recovery of Scots Pine in the Koli hills from snow damage in the winter of 1947–48.]** *Commun. Inst. for. Fenn.* 41 (2), 1953. pp. 43. 18 refs. [Fi.fi.g.]

A detailed study was made in Central Finland, where much damage was caused by snow in the winter of 1947–48. The needles that replaced damaged foliage in the following growing season (1948) were considerably larger than normal, and in the 1949 growing season numerous short shoots arose from adventitious buds. It is concluded, from these and other observations, that the replacement of a leader takes 2–9 years in trees that have lost $\frac{1}{3}$ of their crown, and 5–15 years in those that have lost $\frac{1}{3}$–$\frac{1}{2}$. Recovery is delayed when the branch that replaces the leader is a very old one.

424. *Soil Conditions. Erosion Effects. Nutrient Deficiencies etc.*

See also No. 4004.

4181. AREFJEVA, V. A., and KEMMERIH, A. O. Usyhanie i gibelj lesov ot črezmernogo uvlažnenija. **[Dieback and death of forests from waterlogging.]** *Priroda, Moskva* 44 (5), 1955 (96–8). [Russ.] A.P.B.

Since 1938–40, waterlogging and flooding have killed large areas of forest, especially Birch, in the S.W. of Western Siberia and particularly in the Tyumen, Chelyabinsk and Kurgan regions. In the last named, ca. 22,500 ha., or 6·5% of the forest area, have been affected. The trouble is attributed partly to the naturally low, flat relief with poor drainage and water-impermeable strata running almost horizontally, partly to large-scale fellings during the war, but mainly to increased rainfall and low summer temperatures (and hence low evaporation) during the period 1938–50.

4182. HALL, T. F., and SMITH, G. E. **Effects of flooding on woody plants, West Sandy dewatering project, Kentucky reservoir.** *J. For.* 53 (4), 1955 (281–5). 6 refs.

A study made in a basin with a shore line of ca. 38 miles, subjected to controlled flooding. Tables show: the % time flooded for each foot of contour during 7 growing seasons (April–Sept.); the contours at which the lowest healthy and the lowest sickly survivor of > 40 species was found; and a summary of reactions in 5 elevation zones. A histogram shows for each species the critical % of growing-season time flooded, which divides the healthy from the sickly and the latter from the dead. These were e.g. for Beech, respectively 3 and 16%; Loblolly Pine 16, 16; *Ulmus alata* 24·5, 25; *U. americana* 24·5, 39; *Populus deltoides* 34, 34; Ash 38, 42. The lethal % for 5 species of Oak ranged from 24 to 41. All trees whose root crowns were periodically flooded > 54% of the growing season, died.

4183. LAFOND, A., and EMOND, M. Étude sur la teneur en calcium, magnésium et potassium des feuilles de sapin, épinette rouge, pin blanc, et pin rouge dans une plantation. **[The content of Ca, Mg, and K in the foliage of *Abies balsamea*, *Picea rubens*, *Pinus strobus* and *P. resinosa* in a plantation.]** *Abstr. in Rep. Quebec Soc. Prot. Pl. 1953*, 1955 (78). [F.]

Chlorotic foliage of plantation-grown *P. resinosa* at Valcartier was analysed together with foliage of *P. strobus*, *Picea rubens*, and *Abies balsamea* growing naturally on the same site. *P. resinosa* from a normal plantation at St. Joachim was used as a control. The concentration of elements in the Valcartier plantations varied significantly between species. Comparison of *P. resinosa* of the two provenances showed almost the same Ca content, but highly significant differences in K and Mg, the chlorotic Pines from Valcartier showing a considerable deficiency in those elements.

4184. WALKER, R. B., GESSEL, S. P., and HADDOCK, P. G. **Greenhouse studies in mineral requirements of conifers: Western Red Cedar.** *For. Sci.* 1 (1), 1955 (51–60). 14 refs.

Seedlings were raised in sand and solution cultures with complete nutrients, with Fe or B withheld, or with N, P, K, Ca, Mg, or S stinted. Young trees were also pot cultured in natural soils, variously fertilized. Six tables give the results in dry weight and length of root and shoot, the mineral content of the foliage etc. and the mineral deficiency symptoms of the 8 elements withheld or stinted.

425. *Chemical Influences (Atmospheric)*

See also No. 3779.

4185. KASUYA, Y., and HASEGAWA, S. **[The damage of plants due to saline winds of typhoon in the southern part of Boso Peninsula.]** *Misc. Inform. Tokyo Univ. For.* No. 10, 1955 (7–14). 4 refs. [Jap.jap.e.]

The salt wind of 25–26 Sept. 1953 carried very little rain, but plants in the coastal area were soaked with sea water. Generally the evergreen broadleaved trees were more salt-tolerant than the deciduous, and damage was greater on the windward, little on the leeward, sides of hills. A table records in 5 degrees of damage the effects of the typhoon in the elevation zones, 50–100, 100–200 and 200–400 m. Some 32 timber species are cited.

4186. BARTHOLOMEW, C. R. **Effect of an agricultural spray on forest trees.** *Quart. J. For.* 49 (2), 1955 (139–40 + 1 photo).

A young mixed plantation on the Glasshampton estate, Worcestershire, adjoins farmland which was sprayed with 2,4-methyl-chlorphenoxy acetic acid [MCPA or Agroxone] at a concentration of 6 gal./39 gal. water, about the middle of May. Many trees, especially Scots Pine, developed severe contortions in leaders and side branches in the ensuing season. Experimental spraying of a number of species with a similar concentration showed varying degrees of damage to foliage (discoloration, shrivelling, wilting, complete kill) and contortion. The only completely resistant species were *Fagus sylvatica* var. *purpurea* and *Crataegus* sp. Varying degrees of injury were sustained by *Aesculus hippocastanum*, *Populus serotina*, *Picea abies*, *P. sitchensis*, *Salix caprea*, *Buxus sempervirens*, *Castanea sativa*, *Acer platanoides*, *Betula pubescens*, *Quercus robur*,

Prunus avium, *Sambucus nigra*, *Fraxinus excelsior*, *Corylus avellana*, and *Larix decidua*. It is suggested that tenancy agreements may need alteration where agricultural land adjoins woodland, if the trees are not to be irreparably damaged by careless spraying.

4187. TARJAN, A. C., and HOWARD, F. L. **Detrimental effects of copper sprays to Norway Maple in Rhode Island**. *Plant Dis. Reptr.* 38 (1), 1954 (58). A.P.B.

Two years' tests on the application of copper sprays to foliage of *Acer platanoides* show that marginal and blotch necrosis resulted on sprayed leaf surfaces.

4188. DAVIS, S. H., JR. **Termite-proofing injuries to shade trees and shrubs**. *Proc. nat. Shade Tree Conf. 1954*, [1955] (35–54).

Cites examples of injury of trees growing as much as 60 ft. from houses that have been protected from termites by soil injection.

43. FOREST FIRES

4189. ITO, E., and KAMIYA, M. **[Statistical observations on the forest fires [that have] occurred in Ogasayama National Forest.]** *Report of the Faculty of Agriculture, Shizuoka University, Iwata* No. 3, 1953 (137–43). 3 refs. [Jap.jap.e.]

An analysis, covering the 62 years from 1891 to 1952, during which there were 53 fires totalling 649 ha. on this 1420-ha. forest. Chief causes were smoking (38% of fires), camp fires (19%) and invasion from outside (11%). Fires occurred almost entirely in winter and spring, February having the most and worst.

431. *Predisposing Factors and Causes. Fire Danger. Fire Behaviour*

4190. NELSON, R. M. **How to measure forest fire danger in the southeast**. *Sta. Pap. Stheast. For. Exp. Sta.* No. 52, 1955. pp. 23.

Recommendations on selecting stations, making measurements, recording, inspecting stations, and training staff.

4191. **Logging slash research**. *Rep. Intermt. For. Range Exp. Sta. 1954*, 1955 (57–9).

A general summary of results to date is as follows: (1) *Rate of fire spread.* The main factor is weight of slash per acre, difference of species being of negligible importance in the current year's slash. Ageing for 1 year reduces rate of spread in most species of slash. The least reduction (practically none) occurs in *Pinus monticola* and the greatest in Douglas Fir. An increase in atmospheric humidity quickly reduces rate of spread in light and medium concentrations of slash, but has no effect in heavy concentrations within 1½–2 hr. of the increase. (2) *Moisture content.* Freshly cut branches and fine twigs generally have a m.c. of 100–150%; m.c. of longer branches and trunks decreases with increasing proportion of heartwood. Needles and fine twigs on lopped branches dry to 10–12% m.c. in 2 weeks of midsummer weather in full sun, in 3 weeks in partial shade, and in 4 weeks in full shade; those still attached to the trunk of a large top, need 6 weeks in full sunlight or half shade, while those in full shade still contain 95–100% moisture after 3 months. Heavy material in sun or partial shade dries to 30% m.c. and in full shade to 40% in 3 months. (3) *Slash disposal.* Chipped material was found to burn actively only during the early afternoon in dry hot weather. Roofing slash piles with building paper saved 1–2 cents/pile in burning costs, and roofed piles ignited and burned out well in very wet weather. [Cf. *For. Abstr.* 16 (No. 517).]

4192. SCESA, S., and SAUER, F. M. **Possible effects of free convection on fire behaviour—laminar and turbulent line and point sources of heat**. *Tech. Pap. Calif. For. Range Exp. Sta.* No. 8, 1954. pp. 47. 17 refs.

A detailed review of the theoretical analysis of laminar and turbulent heat sources as affecting a free convective flow, with the aim of establishing a working model for the convection-column behaviour induced by a fire on the surface of the earth.

432. *Prevention and Control*

See also Nos. 3722, 4191, 4207.

4193. **Manual for forest fire control: Fire organization**. Northeastern Forest Fire Protection Commission, Patlen Building, Chatham, N.Y. 1954. pp. 187 + 73. Price $1·50.

A reference manual designed for the use of forest fire control officers.

4194. LEHMAN, J. W., and VOGENBERGER, R. A. **The rôle of a regional agency in forest fire control**. *J. For.* 53 (6), 1955 (430–5).

Summarizes the activities and accomplishments of the Tenessee Valley Authority in its first 20 years' work in conjunction with 7 valley States and 125 counties in the prevention and suppression of fires. The enlistment of public co-operation (films, posters, literature etc.) and the use of demonstration areas is detailed.

4195. **Detecto Vision**. *Equipm. Note, FAO* No. *E*.4.54, 1954. pp. 1.

Describes briefly a television set designed for forest-fire detection by B. Maeser and C. Le Blanc, Baton Rouge, La.

4196. **Fire line plow performance**. *E.D. Rep. U.S. For. Serv.* No. 33, 1955. pp. 54.

Extensive tests were made of a number of commonly used types of plough on a variety of vegetation and soil types. The results are set out and discussed fully. Dynamometer tests showed that the design of combined rolling coulter, plough, and discs is the most efficient, in that it moves a given volume of earth from a fireline furrow with minimum expenditure of power; but it is not suited to very stony or rocky ground, where a mouldboard plough is more effective and dependable. The factors of convenience, organization, and costs, speed of transport etc. that affect the choice and number of ploughs to be acquired by a fire-fighting organization, are also discussed.

4197. **Investigation and tests of backfiring projectiles and protecting devices 1953–1954**. *E.D. Rep. U.S. For. Serv.* No. 32, 1955. pp. 12.

Summarizes experiments at the Arcadia Equipment Development Centre, to find suitable equipment for counter-firing from the ground or from helicopters, in fire-fighting. Several types of grenades, flares etc., shotguns, Verey pistols, coastguard guns etc., are described, and recommendations made for their use.

435. *Benefits of Fire Control. Injurious Effects of Fire. Fire Losses*

See also Nos. 3871, 4095–6.

4198. MYERS, J. W., JR. **Forest fire insurance now a reality.** *For. Fmr.* 14 (7), 1955 (4–5).

The South Carolina Insurance Co. of Columbia, S.C., is now accepting applications for coverage in the southern states. The forest insurance policy is designed to provide coverage from fire and lightning damage for planted young trees and merchantable standing timber, but not for natural unmerchantable stands. Details of policies are given. Basic rates per $100 coverage vary from $0.50 for Arkansas and Virginia to $2.24 for Mississippi.

4199. AUSTIN, R. C., and BAISINGER, D. H. **Some effects of burning on forest soils of Western Oregon and Washington.** *J. For.* 53 (4), 1955 (275–80). 1 ref.

An interim report comparing the physical and chemical properties of soils in burned and unburned plots with details of 3 case histories of areas of poor growth, all referable to the effects of fire.

4200. FULLER, W. H., SHANNON, S., and BURGESS, P. S. **Effect of burning on certain forest soils of Northern Arizona.** *For. Sci.* 1 (1), 1955 (44–50). 23 refs. (*Tech. Pap. Ariz. agric. Exp. Sta.* No. 338.)

A detailed comparison of the chemical, physical, and microbiological effects of uncontrolled (severe), controlled (light), and slash-pile burning in a Ponderosa Pine area, with details of the techniques used.

436. *Beneficial Effects of Fire. Uses of Fire in Silviculture and Other Forms of Husbandry*

See also Nos. 3748, 3871, 3947–8, 4095–6, 4191, 4199–4200.

4201. BURCHAM, L. T., and SAMPSON, A. W. **Costs of controlled burning—records reveal comparative costs of controlled burns and wildfire suppression are affected by acreage.** *California Agriculture, Berkeley* 8 (9), 1954 (8–9, 15). L.S.

Weighs costs of controlled burning (estimated on the basis of operations in northern California in 1947 and 1948) against costs of wildfire suppression in the same area. It seems doubtful whether controlled burning on areas of appreciable size is justified on the basis of a saving in fire-suppression costs alone.

4202. MOORE, E. B., SMITH, G. E., and LITTLE, S. **Wildfire damage reduced on prescribe-burned areas in New Jersey.** *J. For.* 53 (5), 1955 (339–41). 4 refs.

Gives examples and enumeration-based data to show how controlled burning, now standard practice in the Pine region of southern New Jersey, not only reduces the damage of wildfire to the growing stock but also makes fire control easier and more effective. [Cf. *For. Abstr.* 10 (No. 2550).]

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

441. *Weeds*

See also Nos. 4011, 4086–8, 4127, 4166, 4186, 4213–4, 4851.

4203. HOY, J. M. **Scale insects associated with Manuka species in New Zealand.** *N.Z. J. Agric.* 89 (6), 1954 (601–4). 5 refs. A.P.B.

Presents maps showing the distribution of various coccids on *Leptospermum* spp. in New Zealand, and describes infestation of *L. scoparium* by two species of *Eriococcus* [cf. *For. Abstr.* 12 (Nos. 1563, 2321–2)]. Within the space of 10 years *Eriococcus* spp. have been artificially established throughout both islands and are now so well distributed that, if further artificial transfer were stopped, the insects would continue to spread naturally. The control of Manuka by this means is the most spectacular example of biological control yet seen in New Zealand.

4204. MULCOCK, A. P. **A disease of Manuka, *Leptospermum scoparium* Forst.** *Transactions of the Royal Society of New Zealand, Wellington* 82 (1), 1954 (115–8 + 1 plate). 6 refs. L.S.

A description is given of the disease caused by the joint effects of a species of *Eriococcus* and the fungus *Capnodium walteri* feeding on the honey-dew. The fungus was isolated and cultured and details are given of morphology and measurements. The disease was reproduced on a host plant free from insects by spraying the plants with a 1% honey solution after inoculation with a culture of the fungus.

4205. RENNERFELT, E. Terminologi för kemiska medel. **[Terminology for chemical substances [for use against forest weeds].]** *Skogen* 42 (10), 1955 (196). [Sw.]

Summarizes recommendations on terminology relating to forest weedkillers, by a conference held in 1954 between heads of scientific institutions, producers and consumers, listing and defining terms under the heads: (1) field of use; (2) time or method of application; (3) nature of effect (selective or non-selective, systemic or non-systemic); (4) chemical composition.

4206. CARVELL, K. L. **Translocation of ammate.** *For. Sci.* 1 (1), 1955 (41–3).

Young plants (*Carya* and *Ligustrum* spp.) were girdled or frilled and treated with NH_4 sulphamate in which the S was radioactive. Radiograms were made and parts of the plants ashed. The poison moves rapidly upwards, apparently in the xylem, and slowly downwards, probably in the phloem. The greater effectiveness of early spring application is probably due to the slower upward translocation, giving greater opportunity for movement into the roots which is very slow.

4207. CRAFTS, A. S., and BUCK, C. C. **Herbicidal properties of arsenic trioxide.** *Bull. Calif. agric. Exp. Sta.* No. 739, 1954. pp. 28. 11 refs.

The herbicidal properties of As_2O_3 were tested in greenhouse, on field plots, and on a field scale on an airfield and on firebreaks in forest and range areas.

It is concluded that it is the most economical chemical to use when sterilization for 5–10 years is desired. The grade known as gray arsenic (90–95% As_2O_3), is satisfactory for this purpose. When used dry as a dust or powder, it is much safer than soluble Na arsenite, though slower in taking effect.

4208. Dahms, W. G. **Chemical brush control on central Oregon Ponderosa Pine lands.** *Res. Note Pacif. Nthwest. For. Range Exp. Sta.* No. 109, 1955. pp. 5.

Arctostaphylos parryana var. *pinetorum* was completely killed and *Ceanothus velutinus* set back when sprayed by hand with 1 lb. 2,4-D/acre. Aerial application was effective with spray volumes of 3 gallons oil emulsion (containing 1 lb. 2,4-D)/acre. Good results were obtained from spraying between May and mid-July. Damage to young Pine was variable.

4209. Lloyd, C. H., and Eley, G. W. **Multiflora Rose eradication.** *J. Soil Wat. Conserv.* 10 (2), 1955 (78–80, 99).

Brush Killer (B.K.), made up of isopropyl esters of 2,4,5-T (13%), and 2,4-D (27%) is recommended as a dormant or foliage spray for the eradication of Multiflora Rose, as follows: dormant spray—1 part B.K. to 25 or 30 parts kerosene or fuel oil; foliage spray—1 part B.K. to 100 parts water.

4210. Bramble, W. C., and Byrnes, W. R. **Effect of certain common brush control techniques and materials on game food and cover on a power-line right-of-way. No. 1.** *Progr. Rep. Pa. agric.Exp.Sta.* No. 126, 1954. pp. 4. 2 refs.

A replicated series of treatments have been set up on a 3-mile section of a power-line right-of-way, designed to compare the effects of spray application on game food and cover of an upland Oak/Hickory forest cover type. These treatments include a summer foliage spray with 2,4-D + 2,4,5-T, a foliage spray with Ammate, a summer basal spray with D + T in oil and in oil/water carriers, and a selective winter basal spray with 2,4,5-T. A uniform plant community has been described covering the right-of-way at the time of spraying. All sprays caused a foliage kill of 80 to 100%, but stem kill varied. The highest % of stem kill was obtained from the summer and winter basal sprays, the highest number of seedlings and single sprouts being missed in the winter application. *From authors' summary.*

4211. Kuntz, J. E., and Riker, A. J. **Chemical control of weed competition in forest plantations.** *For. Res. Note Univ. Wis.* No. 9, 1952. pp. 2.

A number of chemicals were tested in young plantations of *Populus deltoides*, *Pinus banksiana* and *P. resinosa* on several types of soil, applied either to the entire plot or to a limited area round trees that were protected. Borascu, CMU, 2,4-D and TCA were all injurious to both Poplar and Pine. CIPC [isopropyl-*n*(3-chlorophenyl)-carbamate] suppressed grasses and apparently did no harm to either Poplar or Pines.

4212. Dillerud, M. Bruken av kjemiske midler mot uønsket vegetasjon i skogbruket. [**The use of chemicals in controlling forest weeds.**] *Norsk Skogbr.* 1 (3), 1955 (89–92). [Nor.]

Includes a table showing the resistance of Norwegian trees, shrubs and herbs to foliage spraying with MCPA, 2,4-D salt and ester, 2,4-D + 2,4,5-T ester, and 2,4,5-T ester, and the kill of shrubs and unwanted hardwoods, using different weights of 2,4-D per dekare. Results are based on work by Statens Plantevern, Ugrasbiologisk Avdeling [State Plant Protection, Weed Biology Division], Vollebekk.

442. *Parasitic Higher Plants. Climbers and Epiphytes*

See also No. 4358.

4213. **Ponderosa Pine mistletoe.** *Rep. Pacif. Nthwest. For. Range Exp. Sta. 1954*, 1955 (27).

In continued studies of spread at Pringle Falls, mistletoe seed dissemination from an isolated overstorey tree was found to cover an elliptical area having a maximum dissemination distance of 132 ft. downwind; this pattern is similar to that in understorey stands. In a virgin stand with the seed source nearer the ground, seed was dispersed to a maximum of 15 ft., and in a dense young pole stand dispersal was very limited. Sprays of 2,4-D and 2,4,5-T esters applied directly to mistletoe plants on saplings and to the bases left after the shoots had been removed, destroyed mistletoe shoots, but new shoots invariably appeared next season. [Cf. *For. Abstr.* 15 (No. 400).]

4214. Singh, B. [**Chemical control of *Loranthus*.**] *Indian For.* 81 (3), 1955 (212). 8 refs.

With reference to a note by K. Kadambi on successful control of *Loranthus* on *Dalbergia sissoo* by injection of $CuSO_4$ and Fernoxone into the infested trees [cf. *For. Abstr.* 16 (No. 621)], the writer of this letter points out that experiments in progress at Sharanpur indicate that different host species react differently to these and other chemicals; $CuSO_4$ is, e.g., highly toxic to *Callistemon lanceolatum*, *Achras sapota*, *Tectona hamiltoniana* and *Citrus* spp.

443. *Fungi and Bacteria*

See also Nos. 3775, 3784–5, 4166, 4187.

4215. Gottlieb, D., Amman, A., and Carter, H. E. **A new antifungal agent, filipin.** *Plant Dis. Reptr.* 39 (3), 1955 (219). A.P.B.

A hitherto undescribed streptomycete produces a metabolite extremely inhibiting to the growth and germination of fungi, but relatively non-toxic to plants.

443.2. Diseases of Seed and Seedlings; Damping Off etc.

See also Nos. 4004, 4012–5, 4043–4, 4261.

4216. Cram, W. H. **Pathogenicity of damping-off isolates.** *Progr. Rep. Dom. For. Nursery Sta. Sask. 1954*, [1955] (85–6).

Seedbed studies in the greenhouse showed that *Rhizoctonia* sp. was the most virulent pathogen, causing both pre- and post-emergence losses to Caragana, White and Colorado Spruce and Scots Pine; *Pythium* sp. was of secondary importance; the

pathogenicity of *Fusarium*, *Alternaria* or nematodes was not established.

4217. VAARTAJA, O. **Phytophthora cactorum in Saskatchewan.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 11 (2), 1955 (2).

This destructive disease of seedlings was identified on cuttings of *Caragana arborescens* and seedlings of *Pinus sylvestris* at Indian Head, Sask., in 1954.

4218. ITO, K., and KONTANI, S. [**Pestalotia parasitic on seedlings of *Chamaecyparis obtusa*.**] *Bull. For. Exp. Sta. Meguro, Tokyo* No. 76, 1954 (63–72). 9 refs. [Jap.jap.e.]

A study of the morphology, germination of conidia, growth of mycelia and parasitology of 4 isolates of *Pestalotia* found on blighted seedlings of *Chamaecyparis obtusa*. Of these, 2 agree in morphology with *P. chamaecyparidis*, one is similar to *P. funerea* and one is probably new. Inoculation trials show that the blight is produced only through wounds.

4219. ITO, K., SHIBUKAWA, K., and TERASHITA, T. [**Etiological and pathological studies on the needle blight of *Cryptomeria japonica*—II. Physiological and ecological characters of *Cercospora cryptomeriae* Shirai, the most important pathogen of the disease.**] *Bull. For. Exp. Sta. Meguro, Tokyo* No. 76, 1954 (27–61). 46 refs. [Jap.jap.e.]

[Cf. *For. Abstr.* 14 (Nos. 425–6).] Under field conditions the fungus overwinters in the host, fresh conidia being produced from mid-April and maturing by early May. This is the chief source of primary infection in the following year. Conidia produced in late autumn are of the 'dauerform' type. They remain viable for > 6 months if kept dry. This kind of overwintering is possible, but it is probably very infrequent in the field. Details are given of the germination and growth of the conidia at various temperatures, humidity, and ion-concentrations, similar data being presented for the growth of 8 isolate colonies, the macroscopic characters of which are described. Bordeaux mixture in strengths of $CuSO_4$ 1 : $Ca(OH)_2$ 1 : H_2O 10–75, completely inhibited conidial germination. [Legends for tables and figures in English.]

4220. SATO, K., OTA, N., and SHOJI, T. [**Experiments on the control of *Septoria* leaf-spot of *Alnus* seedlings by fungicides, with special reference to effects of spraying fungicides upon the growth of seedlings.**] *Bull. For. Exp. Sta. Meguro, Tokyo* No. 77, 1955 (15–20). 7 refs. [Jap.jap.e.]

The growth in height, diameter and weight of seedlings of *Alnus firma* after spraying (300 c.c./sq. m.) with 4 chemicals or formulations are compared. Injury by *Septoria alni* was classified, on the basis of mean weight of seedlings in grams, as (*a*) slight (77 g.); (*b*) moderate (22 g.) and (*c*) severe (3 g.) and an index of injury calculated (based on % decrease in weight) for each treatment as $97a + 73b + 5c$ divided by the total number of seedlings. Bordeaux mixture (1 : 1 : 25) diluted with 5 volumes of water [?] gave the best results in index and in each growth factor.

443.3. Diseases of Older Stages

Stem, Butt and Root Rots; Root Diseases

See also Nos. 3818, 4169, 4262.

4221. TRUE, R. P., TRYON, E. H., and KING, J. F. **Cankers and decays of Birch associated with two *Poria* species.** *J. For.* 53 (6), 1955 (412–5). 4 refs.

In the Monongahela National Forest, W. Virginia, *Poria laevigata* and *P. obliqua* cause extensive cull in Birch. The field recognition and the internal damage caused by these fungi are discussed in detail with photographs. Both can usually be diagnosed reliably in the field by trained personnel. [Cf. *For. Abstr.* 15 (No. 1499).]

4222. NIKOLAEVA, T. L. K voprosu o vozbuditeljah 'čagi'. [**The causal agents of 'sterile conks'.**] *Bot. Ž.* 40 (2), 1955 (233–7). 17 refs. [Russ.] [Botaničeskiĭ Institut im. V. L. Komarova Akad. Nauk SSSR, Leningrad.]

Briefly discusses relevant literature (mainly Russian and American) and identifies the fungi causing sterile conks on Birch (Leningrad), Alder (Leningrad) and Beech (Transcaucasia), from pure cultures which formed sporophores, as respectively *Poria obliqua*, *P. andersonii* (perhaps an ecological form of *P. obliqua*), and *Polyporus glomeratus*—all placed under the genus *Inonotus*. The fungi causing such conks on other species, e.g. Rowan and Elm, are still unidentified.

4223. STILLWELL, M. A. **Decay of Yellow Birch in Nova Scotia.** *For. Chron.* 31 (1), 1955 (74–83). 2 refs.

A study of the amount and types of decay in Yellow Birch (*Betula lutea*) in Nova Scotia was undertaken in 1951 and 1952. A total of 374 trees was examined, of which 35% contained some measure of decay, ca. 50% contained decay at 120 to 130 years of age, and 100% at 230 years of age. Volume of decay increased with increasing age. The loss in merchantable volume increased from a negligible amount at 60 years to about 10% at 240 years. No attempt was made to estimate a rotational cut based on diameter. A pathological rotation age of 170 years is suggested for Yellow Birch in Nova Scotia. Ten wood-destroying fungi were found associated with rot in living trees, five in the butt and five in the trunk. *Poria cocos* caused the most frequent butt rot and *Fomes igniarius* the most common trunk rot. *From author's summary.*

4224. ANDREWS, S. R. **Red rot of Ponderosa Pine.** *Agric. Monogr. U.S. Dep. Agric.* No. 23, 1955. pp. ii + 34. 35 refs.

A detailed study and review of literature on red rot of *Pinus ponderosa* caused by *Polyporus anceps*, a disease serious only in Arizona, New Mexico and S. Dakota. Although the organism is abundant on coniferous slash of many species in the U.S. and Canada, it rarely if ever attacks living trees except in the above regions.

4225. TOOLE, E. R. ***Polyporus hispidus* on southern bottomland Oaks.** *Phytopathology* 45 (3), 1955 (177–80). 6 refs.

A fuller account of the host species, % of cull, rate of growth and incidence than is given in the initial reference. [See *For. Abstr.* 16 (No. 1910).]

4226. IGMÁNDY, Z. A fenyötapló (*Trametes pini* (Thore) Fries.) elöfordulása és károsítása hazankban. **[Occurrence and severity of *Fomes pini* in Hungary.]** *Erdömérnöki Föiskola Közleményei Sopron, Budapest* 1954 (1955), (5–10). 15 refs. [Hu.russ.g.]

Both varieties occur in the Carpathian basin: on the W. side the typical form, on *Pinus sylvestris*; on the E. side the var. *abietis*, chiefly on *Picea abies*. The typical form has been noted by the author as far W. as Sopron, where it is sporadic, but in the natural Pine of Bakony Forest it reaches a high incidence, one 100-year-old stand having 16·5% of its trees attacked.

4227. DOMAŃSKI, S., and DZIĘCIOŁOWSKI, W. Zgnilizny odziomkowe sosny zwyczajnej i ich warunki rozwojowe. Część II. Wpływ warunków glebowych w lesńictwie Dobrygość (nadleśnictwo Rychtal). **[Butt rot of Scots Pine and the conditions of its development. II. Influence of soil conditions in Dobrygość forest region (forests of Rychtal, West Poland).]** *Acta Soc. Bot. Polon.* 24 (1), 1955 (65–93). 25 refs. [Pol.e.] O.B.D.

[Cf. *For. Abstr.* 13 (No. 3978).] Investigations in the Poznań district confirmed *Polyporus circinatus* as the commonest causal agent of butt rot. Infection begins mainly in the deep roots (particularly the tap root) and is more frequent when the tap root is small and the soil dry and highly aerated. Infection was most widespread in sandy soil with a large admixture of gravel and stones and least widespread in sandy soil lying on loam. *From authors' summary.*

4228. SASAKI, T., and YOKOTA, S. **[Wood decay of *Abies sachalinensis* forest in Tokyo University forest in Hokkaido.]** *Misc. Inform. Tokyo Univ. For.* No. 10, 1955 (15–21 + 7 photos). 7 refs. [Jap.jap.e.]

Fungal decay, mainly root rots, occurred in 87·6% of the stems > 40 cm. in d.b.h. over the 1·25 ha. surveyed. *Fomes annosus* and *Polyporus schweinitzii* were chiefly responsible, but *Polyporus balsameus*, *Fomes pinicola* and *Polyporus sulphureus* were important; the stem rot *Fomes hartigii* was not. The root-rot distribution indicated infection from plant to plant, and damage was less where stocking was less dense. Silvicultural remedies would probably reduce damage. *From authors' summary.*

4229. **Special conference on root- and butt-rots of forest trees by *Fomes annosus*, Bosbouwproefstation T.N.O. Wageningen, July 22–26, 1954.** International Union of Forest Research Organizations [Zürich]. [1955]. pp. 30. [E.]

Includes the following papers, with discussion: Research on forest sites at the Forest Research Station T.N.O. (*C. P. van Goor*); Investigations on root rot problems in Sweden (*E. Rennerfelt*); Root rot of forest trees in Germany (*H. Zycha*); Survey of experiences concerning root-rots in second-growth conifer plantations in eastern parts of the U.S.A. (*J. S. Boyce*); Dying of White Spruce in patches in Saskatchewan (*J. E. Bier*); Root rots and sites in Michigan (*D. V. Baxter*); *F. annosus* attack in relation to soil conditions, especially biological antagonistic factors (*J. Rishbeth*); *F. annosus* attack in relation to thinning (*E. Jørgensen*); Experiences of root rots of tea in Java (*A. F. Schoorel*); Observations in the United Kingdom and in North America on non-parasitic factors as initiating agents in the development of root-disease (*W. R. Day*): and the design and prospects of long-term experiments on replanting areas infected by *F. annosus*.

4230. CAMPBELL, W. A., and HEPTING, G. H. ***Fomes annosus* on Slash Pine.** *Plant Dis. Reptr.* 38 (3), 1954 (217). 5 refs. A.P.B.

In 1952, root decay of 15-year-old *Pinus elliottii* in S. Carolina was found to be due to *F. annosus* infection. A 15- to 20-year-old natural stand in Georgia gave indications that thinnings may help to spread root rot.

4231. HUBERT, E. E. **Decay—a problem in the future management of Grand Fir.** *J. For.* 53 (6), 1955 (409–11). 9 refs.

Stands of *Abies grandis* in N. Idaho amount to 5·7 thousand million bd. ft., the third highest in volume for the area. The trees suffer considerably from heartrot caused by *Echinodontium tinctorium* and from the butt and root rots *Poria weirii* and *Armillaria mellea*. Co-ordinated studies are recommended for the early study of these diseases and their control, and of effective means of disposing of defective timber. A pathological rotation is suggested. [Cf. *For. Abstr.* 3 (p. 100).]

4232. ***Poria weirii* root rot of Douglas Fir.** *Rep. Pacif. Nthwest. For. Range Exp. Sta. 1954*, 1955 (28–9).

On a 15-acre clear-felled area in a 112-year-old stand on the Gifford Pinchot National Forest, the % of living trees with infection visible on the stump varied inversely with distance from the nearest tree killed by the disease. Within 10 ft. and at distances of more than 50 ft., infected trees formed 88% and 4% respectively of living trees. Infection was most frequently visible on the portion of the stump towards the nearest killed tree, but the average extent of decay within bore no relation to distance from the nearest killed tree. Disease was shown to have spread from several distinct centres, most of which were undoubtedly active in the preceding stand. Particulars of surveys on the occurrence of the disease in conifer stands on the Gifford Pinchot and Olympia National Forests are given.

4233. CHILDS, J. F. L., and WEST, E. **Butt rot of Queen Palms [*Arecastrum romanzoffianum*] in Florida associated with *Ganoderma sulcatum*.** *Plant Dis. Reptr.* 37 (12), 1953 (632–3). 3 refs. A.P.B.

Brief notes on some symptoms of attack and on isolation experiments.

4234. THORN, W. A., and ZENTMYER, G. A. **Hosts of *Phytophthora cinnamomi* Rands.** *Plant Dis. Reptr.* 38 (1), 1954 (47–52). 59 refs. A.P.B.

Lists hosts (including many forest trees) collected from a survey of literature published up to July 1953.

4235. KRSTIĆ, M. **Note on the inhibitory activity of some microorganisms against *Phytophthora cinnamomi*.** *Plant Dis. Reptr.* 38 (12), 1954 (879–81). 3 refs. A.P.B.

Limited preliminary studies indicated the sensitivity of *P. cinnamomi* towards *Bacillus subtilis* (strain A2), a species of *Penicillium*, and *Pleurotus griseus*, on potato dextrose agar in Petri dishes. Trials were much too restricted to permit definite conclusions, but the results suggest the desirability of testing the effects of *B. subtilis* and *Penicillium* sp. on *P. cinnamomi* under natural conditions. *From author's summary.*

Wilts, Diebacks etc.

See also Nos. 3775, 4680.

4236. HOLMES, F. W. **The Dutch Elm disease as investigated by the use of tissue cultures, antibiotics and pectic enzymes.** *Abstr. of thesis*, in *Dissert. Abstr.* 15 (1), 1955 (6). [Cornell University.] O.R.S.

A technique for obtaining tissue cultures of woody plants at any time of the year from their germinating seeds was used on *Ulmus americana*, *U. glabra*, *U. pumila* var. *arborea*, *Gleditsia triacanthos* and *Ailanthus altissima*. Growth of tissue cultures of *U. americana* was not affected by addition to the medium of filtered extract of *Graphium* [*Ceratostomella*] *ulmi* growth on Zentmyer's medium. The fungal extract caused wilt of Elm shoots. Coremiospores of *G. ulmi* germinating in various media produced a pectic enzyme or enzymes that rotted potato discs and blackened broad-bean leaves. The possible action of breakdown products of pectin on the plant structure are discussed; they could cause the Dutch Elm disease syndrome. Nine out of 19 commercially available antibiotics inhibited *G. ulmi* at 1000 p.p.m. in culture, but all 19 and 3 others injected into young Elms failed to prevent establishment of the disease from later artificial inoculation. Isonicotinic acid hydrazide killed Elms at 10,000 p.p.m. and failed to decrease disease at 4 lower concentrations. Cultures of 198 known and 176 unidentified fungi, bacteria, and actinomycetes, grown next to *G. ulmi*, showed various inhibitory qualities not limited to any particular taxonomic groups. The most effective, *Bacillus polymyxa*, inoculated into Elms 6 days before they were inoculated with *G. ulmi* failed to prevent the disease.

4237. BRETZ, T. W. **Sterile distilled water as a medium for the isolation of the Oak wilt fungus.** *Plant Dis. Reptr.* 37 (12), 1953 (630–1). A.P.B.

Sterile distilled water compares very favourably with malt/agar medium in the recovery of the Oak wilt fungus from infected samples.

4238. YOUNT, W. L. **Identification of Oak wilt isolates as related to kind of inoculum and pattern of disease spread.** *Plant Dis. Reptr.* 38 (4), 1954 (293–6). 10 refs. A.P.B.

Seventy-nine isolates of *Endoconidiophora fagacearum* from 54 Pennsylvania Oak-wilt areas were identified by compatibility type. Thirty-five isolates were of A type; 32 were B; and 12 were mixed A and B. In 16 out of 19 infection areas afforded by this material, both A and B strains were present within the same area (35 areas had only one single-strain isolate identified, 3 multiple-isolate areas were single-strain). Both A and B strains were present in every county where more than one isolate was identified. The presence of A and B strains in most Oak-wilt areas provides the fungus elements for the production of ascospores in such areas. Ascospores may be an important kind of inoculum. *Author's summary.*

4239. ENGELHARD, A. W. **Occurrence of Oak wilt fungus mats and pads on members of the Red and White Oak groups in Iowa.** *Plant Dis. Reptr.* 39 (3), 1955 (254–5). 6 refs. A.P.B.

Observations on the time, frequency and abundance of mat and pad formation over a period of 2 years. Mats and pads on members of the Red Oak group were first observed in July 1952 and on *Quercus macrocarpa*, a member of the White Oak group, in May 1954. The fungus structures were observed throughout the 12 months of the year, and were found to be formed most prolifically during 2 periods, the first beginning in the third week of August and continuing through October, and the second in the third week of April and continuing through the first week in June. [Cf. *For. Abstr.* 16 (No. 1918).] *From author's summary.*

4240. MORRIS, C. L. **Control of mat formation by the Oak wilt fungus by early felling of diseased trees.** *Plant Dis. Reptr.* 39 (3), 1955 (258–60). 5 refs. A.P.B.

Trees in varying stages of foliar wilt resulting from infection by *Endoconidiophora fagacearum* were treated by 3 methods: (1) felling, (2) deep girdling and (3) Na arsenite painted on a band girdle. Of 153 trees treated, in stages of defoliation ranging from 20 to 100%, mycelial mats were produced on only 1·3%. All completely-wilted trees in this group were treated within 2 weeks of the time when defoliation was complete. On one-third of 29 infected trees that remained standing 6 weeks or longer before treatment, mats were formed. Of the 3 treatments (3) gave the most rapid kill of the cambium, but (1) and (2) were almost equally effective.

4241. MORRIS, C. L., THOMPSON, H. E., HADLEY, B. L., JR., and DAVIS, J. M. **Use of radioactive tracer for investigation of the activity pattern of suspected insect vectors of the Oak-wilt fungus.** *Plant Dis. Reptr.* 39 (1), 1955 (61–3). A.P.B.

Observations included the following points: (1) There was little nitidulid activity until air temperature reached 70° F.; (2) mycelial mats of the fungus proved powerful insect attractants; (3) there was no apparent relationship between age of wounds and their attractiveness.

4242. JEWELL, F. F. **Viability of the conidia of *Endoconidiophora fagacearum* Bretz, in the fecal material of certain Nitidulidae.** *Plant Dis. Reptr.* 38 (1), 1954 (53–4). 4 refs. A.P.B.

Tests showed clearly that conidia of the Oak wilt fungus can pass through the intestinal tract of the nitidulid beetles in a viable condition, and could serve as inoculum and cause infection if deposited on suitable fresh wounds.

4243. YOUNT, W. L., JEFFERY, A. R., and THOMPSON, H. E. **Spores of *Endoconidiophora fagacearum* on the external surfaces of the body of nitidulids.** *Plant Dis. Reptr.* 39 (1), 1955 (54–7). 7 refs. A.P.B.

Endoconidiophora fagacearum was isolated from beetles of the family Nitidulidae (*Epuraea* spp. and *Colopterus niger*) in spring and late autumn, when fresh mats were being formed. A low % of free-flying insects, caught away from wilted trees, yielded positive cultures of the fungus. The fungus lived for more than 3 months on the bodies of insects kept in the refrigerator at 9° C. *From authors' summary.*

4244. THOMPSON, H. E., HADLEY, B. L., JR., and JEFFERY, A. R. **Transmission of *Endoconidiophora fagacearum* by spore-infested nitidulids caged on wounded healthy Oaks in Pennsylvania.** *Plant Dis. Reptr.* 39 (1), 1955 (58–60). 6 refs. A.P.B.

The low % of infections obtained by caging nitidulids (previously exposed to ascospore-producing mats) on fresh wounds, indicates that the transmission of Oak wilt by insects is not so simple as at first supposed.

4245. BOYCE, J. S., JR. **Nitidulid beetles released 500 feet away reinfest Oak wilt fungus mats.** *Plant Dis. Reptr.* 38 (3), 1954 (212–3). 3 refs. A.P.B.

4246. MCMULLEN, L. H., DRAKE, C. R., SHENEFELT, R. D., and KUNTZ, J. E. **Long distance transmission of Oak wilt in Wisconsin.** *Plant Dis. Reptr.* 39 (1), 1955 (51–3). 5 refs. A.P.B.

Further experiments confirmed the ability of Nitidulidae to transmit Oak wilt by means of the endoconidia and again emphasize the critical factor of season of transmission. Species are listed (1) capable of transmitting Oak wilt, and (2) not transmitting the disease.

4247. YOUNT, W. L. **Longevity of the Oak wilt fungus in Oak roots as related to spread through root grafts.** *Plant Dis. Reptr.* 39 (3), 1955 (256–7). 5 refs. A.P.B.

Isolations from trees with known histories showed that *Endoconidiophora fagacearum* can live 3 years or more in diseased roots of dead trees. When stumps are treated with Ammate the roots remain untouched and may constitute sources of inoculum and means of spread of the disease through root grafts. [Cf. *For. Abstr.* 11 (No. 3293); 16 (No. 648).]

4248. NORRIS, D. M., JR. **Natural spread of *Endoconidiophora fagacearum* Bretz to wounded Red Oaks in Iowa.** *Plant Dis. Reptr.* 39 (3), 1955 (249–53). 7 refs. A.P.B.

Presents the results of several studies on the rôle of wounds in the natural spread of *E. fagacearum*. Natural spread occurred in 31 of 122 Red Oaks wounded during the period 24 April to 22 June. Only 2 of 217 control trees wilted; these were wounded by rodents and Oak wilt symptoms developed progressively from the injured area on each tree. Highest % of infection occurred in trees wounded between 11 and 22 May. A single wounded Red Oak located in an otherwise wilt-free group of Red Oaks attracted vectors carrying sufficient inoculum to infect and kill it. [Cf. *For. Abstr.* 15 (No. 3743).] *From author's summary.*

4249. ZUCKERMAN, B. M. **Relation of type and age of wound to infection by *Endoconidiophora fagacearum* Bretz.** *Plant Dis. Reptr.* 38 (4), 1954 (290–2). 2 refs. A.P.B.

Greenhouse experiments in wounding and inoculating *Quercus rubra* and *Q. virginiana* showed that wounds < 24 hours old provide a more favourable ingress to fungi than older wounds. Infection was obtained more easily through wounded stem surfaces than wounded leaves. No infection was obtained through wounded buds, wounds left by broken-off buds, or in uninjured trees.

4250. ZUCKERMAN, B. M. **Effects of ionizing radiations, ultrasound, and several chemicals on the Oak wilt fungus.** *Abstr. of thesis*, in *Dissert. Abstr.* 15 (1), 1955 (21). [University of Illinois.] O.R.S.

X-radiation permanently inactivated 50% of the conidia at dosages of 16,500 ± 2500 R units, the number of germinating conidia decreasing and the time lapse before maximum germination and secondary spore production increasing with increased dosage. At dosages over 50,000 R, germinated spores did not give rise to secondary conidia. After exposure to dosages of 30,000 to 80,000 R most of the conidia that germinated produced germ tubes with maximum lengths 2–6 times the length of the parent spore, compared with 20–30 times for unirradiated spores. At dosages of 50,000 to 110,000 R many conidia formed short knob-like projections and then ceased developing. Growth in a liquid medium and ability to produce a metabolite toxic to Oak and tomato cuttings was not changed by X-radiation. The pH change followed the same course in irradiated cultures and controls. Irradiated cultures were pathogenic, and when crossed with isolates of a compatible strain produced fertile perithecia. There was a ratio of 3 mutants in irradiated to 1 in control cultures. Mutant sectors were all pathogenic. Irradiation with a mixed α source, U 238, killed the fungus. Therapy using U as an external source of radiation was unsuccessful. U nitrate injected into seedling Oaks did not halt the disease but retarded early symptoms. The lowest concentrations injured the leaves but did not kill the Oaks. Several dosage rates of ultrasound did not affect rate or % of germination of conidia, growth in liquid media, exometabolite production, pathogenicity or ability to form fertile perithecia. Exometabolite production and pathogenicity of the fungus were not altered by growth in several concentrations of 3 chemotherapeutants and U nitrate. M4367 inhibited fungus growth at 1·0 p.p.m., accelerated it at 0·1 p.p.m. and totally inhibited it at 5·0 p.p.m. Sub-lethal concentrations of the other chemotherapeutants did not affect the amount of fungus growth. The fungus was re-isolated from the year-old wood of a tree that had been successfully treated with M4367: growth, exometabolite production, pathogenicity and ability to form fertile perithecia had not been affected by contact with the chemotherapeutant within the tree.

4251. BAKSHI, B. K. **Wilt disease of Shisham (*Dalbergia sissoo* Roxb.). II. Behaviour of *Fusarium solani*, the wilt organism, in soil.** *Indian For.* 81 (4), 1955 (276–81). 11 refs.

The organism has been found to be generally distributed and occurs in soil bearing both healthy and wilted trees. It is usually found in the soil in the form of hyphae. Its saprophytic activity is investigated and it is concluded that it is impracticable to eliminate it from the soil by rotation, fallowing etc. [Cf. *For. Abstr.* 16 (Nos. 649–50).]

4252. FERREIRINHA, M. P. Identificação de uma doença de *Pinus insignis* Dougl. e de *Pinus pinaster* Sol. ex Ait. **[Identification of a disease of *P. radiata* and *P. pinaster*.]** *Estud. Inform. Serv. flor. aqüic. Portugal* No. 46–C3, 1955. pp. 43 + 5 photos. 28 refs. [Port.port.e.] Limited distribution.

Death of *P. radiata* and *P. pinaster* in Portugal was found to be due to attack by *Diplodia pinea*. Experimental inoculations in plants 3–8 years old proved that the pathogen can equally well attack *P. pinea*, *P. canariensis* and *P. halepensis*. Symptoms of the disease are described, with notes on its distribution in Portugal, economic significance and some general recommendations (not yet tested) for control.

4253. CAPRETTI, C. Il disseccamento dei rami di pino causato da *Diplodia pinea* (Desm.) Kickx. **[Die-back of Pine caused by *D. pinea*.]** *Monti e Boschi* 6 (6), 1955 (271–4). [It.f.e.]

D. pinea occurs in Italy on *Pinus nigra*, *P. pinea*, *P. sylvestris*, *P. halepensis* and *Pseudotsuga taxifolia*. *P. nigra* appears to be the most susceptible species. The disease is not serious unless trees are growing in unfavourable conditions.

4254. GARREN, K. H. **Second report on leader die-back of Sweetgum.** *Plant Dis. Reptr.* 38 (2), 1954 (91–2). 6 refs. A.P.B.

Isolations from young stems showing leader die-back have been consistently ca. 60% *Diplodia* spp., 30% *Nectria* spp. and 10% a black, slow-growing non-sporulating organism. Four-year-old Sweetgum inoculated with *Diplodia* sp. developed symptoms of leader die-back. Data are presented showing development of the disease during 1949–53 at Auburn, Alabama. [Cf. *For. Abstr.* 11 (No. 3365).]

4255. PACLT, J. **Synopsis of the genus *Catalpa* (Bignoniaceae). Part VII (Addenda 2).** *Phytopath. Z.* 21 (3), 1954 (329–32). 5 refs. [E.g.] I.M.I.

Trees of *C. bignonioides* were found in Bratislava suffering from a dieback caused by *Tubercularia confluens*.

4256. OGAWA, J. M. **The occurrence of *Hendersonula toruloidea* Nattrass on *Populus* species in California.** *Plant Dis. Reptr.* 38 (3), 1954 (238). 3 refs. A.P.B.

H. toruloidea, a major pathogen of Persian Walnut and fast becoming a serious menace of Citrus and Fig in California, was isolated from dead *Populus fremontii* and from dead branches on living Poplar in Fresno County.

Cankers, Stem Rusts etc.

See also Nos. 3914, 4221–2.

4257. PEACE, T. R. **Sooty bark disease of Sycamore [*Acer pseudoplatanus*]—a disease in eclipse.** *Quart. J. For.* 49 (3), 1955 (197–204). 8 refs.

Surveys carried out from 1949 to 1954, have disclosed that the disease associated with the fungus *Cryptostroma corticale* has declined enormously in virulence and is, at the moment, of no economic importance. Possible reasons for this reduction in vigour are discussed. *From author's summary.*

4258. BIRAGHI, A. Il 'cancro della corteccia' ed i suoi riflessi sulla crisi del castagno. **[*Endothia parasitica* canker as a factor in the Chestnut crisis.]** *Ital. for. mont.* 10 (2), 1955 (49–57 + 13 photos). [It.it.f.]

Reviews 16 years' observations on the disease, describes the present condition of Chestnut stands in Italy, and makes some recommendations on sanitation measures.

4259. ANDERSON, R. L., and FRENCH, D. W. **Evidence of races of *Cronartium ribicola* on *Ribes*.** *For. Sci.* 1 (1), 1955 (38–9).

Leaves of *Ribes nigrum* were inoculated with aeciospores from (*a*) *Pinus strobus*, (*b*) *P. lambertiana* and (*c*) *P. monticola*, of various provenances from New York to California. A clonal line of *R. hirtellum* was inoculated under controlled conditions with the uredospores so produced, and this test was repeated with fresh collections from the Pines. Four collections of (*b*) produced on the leaves of *R. hirtellum* large necrotic areas surrounded by chlorotic areas. Five collections of (*a*) and one of (*c*) produced large chlorotic spots with no necrosis. This indicates the existence of races, but whether the races vary in pathogenicity, can be proved only by inoculating the respective 5-needle Pine hosts. Details are given of 9 other species of *Ribes* in which the reactions are less marked, and of one hybrid in which no infection was obtained.

4260. LEAPHART, C. D. **Preliminary observations on a current outbreak of western gall rust (*Cronartium coleosporioides*).** *Plant Dis. Reptr.* 39 (4), 1955 (314–5). A.P.B.

The outbreak is concentrated in a few centres along Clark Fork River. It occurs in both even- and uneven-aged stands of Ponderosa Pine, and appears to have begun 15–20 years ago. Analyses of galls show that they invariably began in 1- to 3-year-old branch wood.

4261. SIGGERS, P. V. **Control of the fusiform rust of Southern Pines.** *J. For.* 53 (6), 1955 (442–6). 13 refs.

Clear felling *Pinus palustris* in the Southern Pine forests releases the Oaks, alternate hosts of *Cronartium fusiforme*. *P. elliottii*, foremost in favour for replanting, and *P. taeda*, an invader of the fire-protected lands, are both more susceptible to the fungus. The author presents a detailed review of the disease, including biology, ecology and distribution, susceptibility of Pine and Oak species, cultural

practices affecting susceptibility, resistant Pine races, temperature, moisture, and time conditions favouring the fungus, damage done to seedlings, poles and timber, rate and mode of canker development, and control in nurseries, natural regeneration and plantations.

4262. PURI, Y. N. **Rusts and wood-rotting fungi on some of the important Indian conifers.** *Indian For. Bull.* (*n.s.*) No. 179, 1955. pp. 10. 11 refs.

Lists rusts and wood-rotting fungi occurring on trees and timber of *Abies pindrow*, *Cedrus deodara*, *Picea morinda*, *Pinus excelsa*, *P. gerardiana*, *P. insularis* and *P. longifolia*.

4263. KHAN, A. H. **Some of the hardwood and coniferous rusts on the forest and avenue trees of Pakistan.** *Pakistan J. For.* 4 (4), 1954 (261–70). 24 refs.

Foliage Diseases

See also Nos. 4109, 4204, 4262–3.

4264. BIEBERDORF, F. W., MEFFERD, R. B., JR., and BLACKMON, C. W. **An undescribed Mesquite rust.** *Bull. Torrey bot. Cl.* 82 (2), 1955 (131–3). 1 ref. O.B.D.

Puccinia prosopidis on *Prosopis juliflora* in Texas. Infected trees have a marked ability to survive infections of even gross proportions. Many are simultaneously infected with *Ravenelia holwayi*.

4265. **Ponderosa Pine needle disease.** *Rep. Intermt. For. Range Exp. Sta. 1954*, 1955 (49–50).

Main results of studies since 1948 in Central Idaho are: (1) greatest intensities of infection occurred in 1950 and 1951; (2) trees recorded as lightly infected in 1951 are still lightly infected, indicating individual resistance; (3) mortality has occurred only among trees classed in 1951 as 'poor' or 'very poor' in vigour because of severe disease; (4) losses have been confined almost entirely to the younger age groups, the largest tree killed being 28 in. in d.b.h. but few young Pine < 5 ft. high appear to be susceptible. The effect of environment on 'resistance' is discussed.

4266. SCHNEIDER, I. R., and CAMPANA, R. J. **Fungicide tests in 1954 for the control of Sycamore [*Platanus* sp.] anthracnose.** *Plant Dis. Reptr.* 39 (1), 1955 (64–5). 8 refs. A.P.B.

Comparisons of various commercial compounds and spraying schedules.

4267. SCHULDT, P. H. **Comparison of anthracnose fungi on Oak, Sycamore, and other trees [in Iowa].** *Contr. Boyce Thompson Inst.* 18 (2), 1955 (85–107). 16 refs.

The fungi were found to be of two types: (1) isolates from Sycamore [*Platanus* sp.], Bur Oak and White Oak, (2) isolates from White Oak, Red Oak, American Elm and Black Walnut. Type (1) is identified with *Gnomonia veneta*, (2) is provisionally referred to *Gloeosporium quercinum*.

4268. SCHMIDLE, A. Über Infektionsversuche mit *Septotinia populiperda* Waterman et Cash an *Populus deltoides*. **[Inoculation experiments with *S. populiperda* on *P. deltoides*.]** *Angew. Bot.* 29 (1), 1955 (14–25). 7 refs. [G.g.] E.M.B.

Artificial inoculation on leaves and bark in the field showed that entry of the pathogen is possible through leaf injuries, so that infection through insect vectors is an important factor. The fungus proved able to spread in the bark and to destroy it, but its spread was limited, the wounds being partially healed before the end of the growing season. [Cf. *For. Abstr.* 13 (No. 4001).]

Miscellaneous

4269. TOOLE, E. R. **Red stain of Boxelder.** *Plant Dis. Reptr.* 39 (1), 1955 (66–7). A.P.B.

Inoculation tests indicated that *Fusarium negundinis* can cause red stain in living *Acer negundo*.

444. *Virus Diseases*

4270. LASRADO, E. A. **Suggestions for future research on the spike disease of Sandal [*Santalum album*].** *Indian For.* 81 (4), 1955 (282–5).

It is suggested that the most rewarding line of research is likely to be genetic, for the development of resistant seedlings and trees.

45. DAMAGE BY ANIMALS

451. *Mammals*

See also Nos. 3765–8, 3951–2, 4035–8.

4271. MORGILEVSKAJA, I. E. Polevka obščestvennaja (*Microtus socialis* Pall.) v drevesnyh pitomnikah. **[*M. socialis* in nurseries.]** *Soobščenija Akademii Nauk Gruzinskoĭ SSR, Tiflis* 14 (6), 1953 (351–5). [Russ.] From *abstr.* in *Referat. Ž.* (*Biol.*) 1954 (1), (No. 866). [Russ.] H.S.B.

Describes the damage done by this vole in a nursery near Tbilisi; the following seeds and seedlings were damaged: *Tilia caucasica*, *Prunus cerasus*, *Prunus avium*, *Morus* sp.

4272. TURČEK, F. J. Množstvo semennej potravy, spotrebované žltohrdlou myšou *Apodemus flavicollis* (Predbežna zpravá). **[Quantity of seed devoured by *A. flavicollis*. (Preliminary report).]** *Les, Bratislava* 2 (3), 1955 (99–102). [Slovak.]

Presents results of laboratory feeding of *A. flavicollis* with seeds of *Fagus sylvatica*, *Tilia platyphyllos*, *Pinus sylvestris*, *Picea abies*, and *Quercus* sp. The quantities of green and dry seeds consumed are given. Seeds are always shelled and blanched by these mice. Many seeds are not wholly consumed.

4273. KINOSHITA, E. **[Studies on the mechanical control of field mice. II. On the effects of control of field mice by a trench.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (65–70). [Jap.jap.e.]

Observations during a further period (Nov. 1953–Oct. 1954) on the catch and on the effective protection afforded by the trenches [see *For. Abstr.* 16 (No. 3160)]. The maintenance of the trenches in good repair is important.

4274. KUWAHATA, T. **Studies on the habitat and dispersal of field mice (1),** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (53–64). 25 refs. [Jap.jap.e.]

[Cf. *For. Abstr.* 16 (No. 3157).] Observations on the distribution and feeding habits of the herb- and grass-eating vole *Clethrionomys rufocanus*

bedfordiae, and the seed-eating *Apodemus geisha* and *A. ainu ainu* in young plantations (clean- and strip-weeded), in a dense stand of *Picea abies* and in three natural communities of secondary forest. A table and histograms with English captions show the population densities of each animal in each vegetation type in September and October and their food (herb, 'stock', seed, fruit, insect). The seed-eating *Apodemus* spp. were taken in numbers in the dense Spruce where the herb layer was sparse; here and in the clean-weeded plantations the herb-eating vole was scarce, but elsewhere its population density was very high.

4275. MAEDA, M. **[Studies on the mechanism of damage to forest trees by field mice. III. Note on a change of ecological habitat of the field mice by weed burning.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (86–96). 24 refs. [Jap.e.]

Burning the weeds in a Larch plantation was followed by a 98% decrease in the mouse population and the proportions of the two species of *Clethrionomys* and two of *Apodemus* was altered. After one year, in spite of weeding and burning, the area appears to have become inhabitable again by mice.

4276. IGARASHI, B. **[Studies on the control of field mice in the afforested stands at Ono national forest, Hokkaido.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (71–85). 13 refs. [Jap.jap.e.]

Grains of corn soaked in a red solution of $CH_2FCOONa$ proved a highly successful poison against *Clethrionomys rufocanus bedfordiae*.

4277. HOOVEN, E. F. **Midsummer baiting to control seed-eating mammals.** *Res. Note Ore. Bd. For.* No 22, 1955. pp. 4.

The results of experiments indicate that control by poison baiting is not practicable in summer or early autumn; better results can be obtained in late autumn or early winter when there is a natural decrease in rodent population.

4278. MARSHALL, W. H., SCHANTZ-HANSEN, T., and WINSNESS, K. E. **Effects of simulated over browsing on small Red and White Pine trees.** *J. For.* 53 (6), 1955 (420–4). 1 ref.

[Cf. *For. Abstr.* 15 (No. 2656).] Transplants of *Pinus resinosa* and *P. strobus* (2 + 3 stock) were subjected to 3 intensities of clipping, in a manner and at a time similar to that of hare and deer browsing. This treatment was repeated annually for 1, 2, 3 and 4 years for the Red Pine, and growth assessed 4 years after the last clipping. Clipping of the more sensitive White Pine was for 2 years only, and growth was assessed 3 years after. Histograms show, over the period, the weight of clippings, average height of tree, length of leader, and numbers with multiple leaders, for both. It is concluded that, while short periods (2–3 years) of severe browsing may not be ruinous to small trees, early reduction of populations of browsing animals is important.

4279. SWITZENBERG, D. F., NELSON, T. C., and JENKINS, B. C. **Effect of deer browsing on quality of hardwood timber in Northern Michigan.** *For. Sci.* 1 (1), 1955 (61–7). 7 refs.

Even under severe initial browsing, satisfactory stocking of *Acer saccharum*, *Ulmus americana*, and *Prunus serotina* was possible. Heartrot was not appreciably greater than in a lightly browsed control, and though crook was about 26% greater, most stems would outgrow it. Where sweep was devoped, however, logs might be downgraded. The longer rotation involved is not considered of great monetary significance. [Cf. *For. Abstr.* 15 (No. 2246).]

452. *Birds*

4280. JUUTINEN, P. Pikkukäpylinnun (*Loxia curvirostra* L.) ravinnosta ja metsätaoudellisesta merkityksestä. **[The feeding habits of the crossbill (*Loxia curvirostra*) and its importance in the forest.]** *Commun. Inst. for. Fenn.* 41 (3), 1953. pp. 41. 103 refs. [Fi.g.]

On the basis of 21 crop analyses, and observation of living birds, as well as review of the literature, it is concluded that the destruction of Spruce seeds and buds by the crossbill more than outweighs the benefit derived from its consumption of harmful insects.

453. *Insects*

See also Nos. 3757–64, 4166, 4188, 4835.

4281. ROONWAL, M. L.; BHASIN, G. D., and ROONWAL, M. L. **A list of insect pests of forest plants in India and the adjacent countries (arranged alphabetically according to the plant genera and species, for the use of forest officers). Part 1. General introduction. Part 2. List of insect pests of plant genera 'A' (*Aberia* to *Azima*).** *Indian For. Bull.* (*n.s.*) No. 171 (1), 1954. pp. 93. Price *Rs.*4.8 or 7*s.*

4282. CHAUDHRY, G.-U. **Some problems of forest entomology in Pakistan.** *Pakistan J. For.* 4 (4), 1954 (241–51).

Brief notes on *Plecoptera reflexa*, a defoliator of *Dalbergia sissoo*; powder-post beetles; pests of coniferous forests, *Populus* spp. and *Salix* spp.; *Tonica niviferana*, a shoot borer of *Bombax malabaricum*; and pests of *Heritiera minor*, *Shorea robusta*, and Teak.

4283. FAURÉ, G. OLALQUIAGA. **Insect pest problems in Chile.** *FAO Plant Prot. Bull.* 3 (5), 1955 (65–70). I.M.I.

[Cf. *For. Abstr.* 7 (No. 966).] Lists forest pests and gives official recommendations for the Pine pests: *Chermes boerneri*, *Catocephalia amphimone* and *Macromphalea dedecora*. *Chrysolina* spp. feeding on *Hypericum perforatum* have been introduced to control that plant. It is planned to introduce other insects to control *Rubus ulmifolius*, now spread over 1,500,000 ha. of crop land.

4284. RÖHRIG, E. Übersicht über die bisher beobachteten Insekten an der Pappel. **[Review of insects found on Poplar.]** *Anz. Schädlingsk.* 28 (3), 1955 (33–40). [G.]

The review is based on literature and is presented in the form of a table showing species, date and locality of discovery, and by whom discovered.

4285. BYTINSKI-SALZ, H. **Insects associated with desert Acacias in Israel.** *Bull. Res. Coun. Israel* 4 (3), 1954 (284–92). 6 refs. A.P.B.

Lists and discusses species found feeding in at least one developmental stage on *Acacia*, spp. but excludes the forms—chiefly Hymenoptera—that can be caught on *Acacia* blossoms.

4286. WEAR, J. F., and BUCKHORN, W. J. **Organization and conduct of forest insect aerial surveys in Oregon and Washington.** Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. 1955. pp. 41.

Equipment, personnel, methods, and costs.

4287. WATERS, W. E. **Sequential sampling in forest insect surveys.** *For. Sci.* 1 (1), 1955 (68–79). 17 refs.

Sequential sampling classifies rather than estimates populations (e.g. light, medium or heavy infestation, presence or absence of an attribute) and units are chosen at random until the cumulative value places the sample within the specified limits. Time saved in comparison with conventional (fixed-sized) sampling is often $> 50\%$ and the decision (e.g. to spray or not to spray) is as accurately based. Its application to insect surveys, sequential plans, and general formulae for binomial, negative binomial, Poisson, and normal distributions are discussed, and a plan is outlined, with computations, tables and graphs, for sampling a Spruce-budworm population. This plan would have saved 70% of the time spent examining twigs for larvae in the 1953 survey in the North-eastern States. [Cf. *For. Abstr.* 16 (No. 1945).]

4288. BRUNS, H. Fortschritte im forstlichen Vogelschutz. [**Advances in the protection of forest birds.**] *Anz. Schädlingsk.* 28 (4), 1955 (51–7). 26 refs. [G.]

Briefly reviews research throwing light on the following questions: (1) To what extent, before and after an outbreak, are particular species of insect destroyed by particular species of bird? (2) What density of bird population is necessary to give effective control of outbreak? (3) What maximum density of population is attained? (4) How can increase of population be encouraged? It is concluded that it is more economical and equally effective to concentrate measures for encouraging bird populations (e.g. installation of nesting boxes etc.) on small areas of the forest, paying particular attention to areas where outbreaks can be expected to recur.

4289. MARISOVA, I. V. Lesohozjaĭstvennoe značenie boljšogo pestrogo djatla. [**Silvicultural importance of *Dryobates major*.**] *Naučnye Zapiski Kievskogo gosudarstvennogo Universiteta, Kiev* 12 (3), 1953 (73–87). [Russ.?] From *abstr.* in *Referat. Ž.* (*Biol.*) 1954 (1), (No. 886) [Russ.] H.S.B.

The stomachs of 95 birds (20 killed between April and Sept., the rest in winter) from Pine and mixed forests in the Kiev region, contained large numbers of insect pests—many of them forest pests. In the author's opinion, the number of Pine seeds eaten by this woodpecker is unimportant and the bird is classed as very useful.

4290. ANGUS, T. A. **Properties of a bacterial toxin affecting insect larvae.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 11 (1), 1955 (3).

Studies of the toxic material isolated from old cultures of *Bacillus sotto* [cf. *For. Abstr.* 16 (No. 1952)] were continued, and its electrophoretic behaviour was studied. It is concluded that the toxin moves as a single entity and should be considered as electrophoretically homogeneous.

4291. THOMPSON, W. R. [Editor], *et al.* **A catalogue of the parasites and predators of insect pests. Section 2. Host parasite catalogue. Part 3. Hosts of the Hymenoptera (Calliceratid to Evaniid).** Commonwealth Institute of Biological Control, Ottawa, Ont., Canada. 1954 (1955), pp. 191–332.

Cf. *For. Abstr.* 15 (No. 3785).

4292. SOLOMON, M. E. **The relative control values of different percentage mortalities.** *Bull. ent. Res.* 46 (1), 1955 (189–91). 1 ref.

Percentage mortality is not *per se* a good index of insecticidal efficiency. Where complicating factors (predators, climate etc.) are absent, control values may be better expressed in time required to regain former population density. In a simple case, a regular exponential rate of increase is assumed, and a straight line showing recovery time against population on a logarithmic scale is drawn. In this, each of the % mortalities in the series 99·6, 93·75, 75, 50 and 29 is twice as good as the one that follows it. Where the rate of increase varies, control values can still be compared by a series of such lines if recovery time to each density can be calculated.

4293. HALLER, H. L. **Common names of insecticides for use in the *Journal of Economic Entomology*.** *J. econ. Ent.* 48 (1), 1955 (112–5). 1 ref.

A revised list, superseding that published *ibid.* 45 (1), 1951 (165–6). The list is confined to the principal organic compounds recently developed and gives the name approved by the insecticide terminology committee of the Entomological Society of America, together with its chemical constitution and other names by which it is known.

4294. SULLIVAN, W. N., HORNSTEIN, I., YEOMANS, A. H., and TSAO, C. H. **Improved deposits for controlling insects outdoors.** *J. econ. Ent.* 48 (2), 1955 (153–5). 6 refs.

The residual effectiveness of both non-volatile (DDT) and volatile (lindane and aldrin) chlorinated organic insecticides (*a*) alone and (*b*) combined with chlorinated terphenyl, was determined by spraying methyl-ethyl-ketone solutions of the mixtures on Pine branches and making periodical assays with houseflies. Method (*b*) greatly extended the life of lindane and aldrin but not of DDT, though this lasted longer in the ketone than in oil solution. The difficulty of applying insecticides in highly volatile solvents is apparently overcome by using very concentrated solutions of insecticide and chlorinated terphenyl. Evaporation of a small amount of the solvent left semi-solid, 100-μ spheres, which dispersed well and adhered tenaciously without penetration.

4295. Bodenstein, G., Bastgen, G., Kauth, H., and Madel, W. Malathion, ein neues Insektizid. **[Malathion, a new insecticide.]** *Anz. Schädlingsk.* 28 (6), 1955 (84–90). 34 refs. [G.g.]

Notes on dosages and effects on aphids, mites, beetles, sawflies and certain species of Diptera and Lepidoptera, the duration of effects, and penetration of the chemical into plant tissues.

4296. Ravensberg, K. Proeven met Systox. **[Trials with E 1059.]** *Jaarb. Proefsta. Boomkwek. Boskoop 1953*, [1954] (17–21). [Du.]

The trials included successful attempts to control greenfly on *Salix*, *Paratetranychus ununguis* in sapwood of *Picea glauca* var. *conica*, and *Pineus pini* on *Pinus* by spraying with different concentrations. Applying the chemical in solution to the soil was ineffective.

4297. Anderson, R. F. **Internal medication of plants for the control of insects.** *J. econ. Ent.* 48 (2), 1955 (187–90). 10 refs.

Quassia extract, purified picrasmin, and parathion were applied to the soil of potted plants, and insects were then fed on the foliage. Among woody-plant pests, *Unilachnus parvus* on Pitch Pine, *Ichthyura inclusa* on Aspen, *Malacosoma americanum* on Cherry, and *Neodiprion lecontei* on Pitch Pine, suffered heavy mortality from the quassia. *Malacosoma* suffered heavily under parathion. Eight other named chemicals failed as systemics.

4298. Matthysse, J. G. **Leaf miners of trees and shrubs.** *Proc. nat. Shade Tree Conf. 1954*, [1955] (20–35). 32 refs.

Experiment has shown that leaf-mining insects can be controlled: (1) on deciduous broadleaved trees by lindane or malathion; (2) on broadleaved evergreens by DDT against adults or parathion against larvae; (3) on conifers by DDT against adults and external larvae and by parathion against larvae in the mines.

4299. Neiswander, R. B. **The control of some gall makers.** *Proc. nat. Shade Tree Conf. 1954*, [1955] (14–20). 6 refs.

Deals with the control of *Phylloxera caryaecaulis*, *Chermes* (*Adelges*) *abietis*, *Eriosoma americanum*, *Colopha ulmicola* and *Vasates quadripes*.

Orthoptera

4300. **New measures for the control of Phasmids (stick insects).** *Timber News Sheet, Suppl.* to *Aust. Timb. J.* Feb., 1955 (1).

Parts of the Bago forest, New South Wales, have been sprayed from low-flying planes with dieldrin for the control of this defoliator, which frequently kills trees, particularly *Eucalyptus gigantea*. Ground spraying of the forest floor and trees was difficult, and only the fringe of the area was satisfactorily treated. The insects mature and lay eggs at the end of February, and the destruction of the hatching insect in early spring is aimed at. Helicopters, by the down-draught of their blades, may be more effective than planes in forcing the insecticide on to the forest floor.

Isoptera

See Nos. 3758-9.

Hemiptera

See also Nos. 3760, 4203–4, 4296–7, 4299, 4306.

4301. Inou(y)e, M., and Yamaguchi, H. **[Aphid problems of the Todo-fir plantation in Hokkaido. (1) The relationship of ants and other organisms to certain aphid pests on Todo-fir plantations at Horonai, Iburi Province in Hokkaido.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (28–41). 18 refs. [Jap.jap.e.]

Shows in tables and graphs, with captions and a comprehensive summary in English: the distribution of aphid-attacked and aphid-free 7-year *Abies mayriana* saplings by height (0·2–2·0 m.) and height-increment classes (0–45 cm.); a statistically based comparison illustrating the severely depressing effect of the aphid attack on average height and average height increment; the numbers and % of trees inhabited by the chief species of aphid-keeping ants (*Camponotus herculeanus obscuripes*, *Lasius niger* and *L. fuliginosus*); and a tree-plot diagram showing their segregated territories. The chief injury is caused by *Cinara todocola*, the damage done by two other species of this genus being unimportant. The pest, though not a killer, is a serious threat to young plantations, debilitating plants and rendering them susceptible to secondary diseases and unfavourable conditions.

4302. Takai, M. **[Results of experiments on killing the eggs of the Ezo-Spruce gall aphid *Adelges japonicus* (Monzen), Adelgidae.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (42–8). 6 refs. [Jap.jap.e.]

Control of the egg stage of this gall of *Picea jezoensis* is difficult on account of the waxy filamentous protection. The following were tried in 3 concentrations (table in English): BHC (wettable powder, emulsion and dust), pyrethrum/BHC and derris/BHC emulsions, nicotine sulphate, parathion emulsion and dust (1·5%). Spring and autumn applications varied in effect (probably with the condition of the waxy filaments). Nicotine sulphate was the most effective, with 100% kill indicated. Highly concentrated emulsions of BHC and derris/BHC gave high % kills. The other insecticides would probably be more effective if thire adherence and spreading properties were improved.

4303. Franz, J. Tannenstammläuse (*Adelges piceae* Ratz.) unter einer Pilzdecke von *Cucurbitaria pithyophila* (Kze. et Schm.) de Not., nebst Beobachtungen an *Aphidoletes thompsoni* Möhn (Dipt., Itonididae) und *Rabocerus mutilatus* Beck (Col., Pythidae) als Tannenläusfeinde. **[*A. piceae* under a fungus cover of *C. pithyophila* with observations on *A. thompsoni* and *R. mutilatus* as predators of *A. piceae*.]** *Z. PflKrankh.* 62 (2), 1955 (49–61). 5 refs. [G.g.e.] E.M.B.

A heavy infestation of *A. piceae* in all stages was found under extensive cover provided by the stroma of *C. pithyophila* on the stems of two sickly Silver Fir trees. The fungus gives some, but not complete,

protection against predators. *Aphidoletes thompsoni* and *Rabocerus mutilatus* larvae were found under the fungus cover, preying on the aphids. The life history of these two predators is discussed. Crowding of the aphids, which are unable to escape from under the fungus cover, the presence of the predators, and the fact that *C. pithyophila* probably occurs only on sickly trees, are factors preventing permanent colonization by the aphids in these conditions.

4304. SWIRSKI, E. **The life-history of *Chromaphis juglandicola* Ketb. (Aphidoidea, Homop.) in Israel.** *Bull. Res. Coun. Israel* 4 (3), 1954 (307). 2 refs. A.P.B.

Presents a table illustrating population fluctuations on leaves of *Juglans regia* throughout the year.

4305. SCHREAD, J. C. **Aphids and scale insects on ornamentals [in Connecticut].** *Bull. Conn. agric. Exp. Sta.* No. 588, 1955. pp. 22.

Prescribes sprays and soil treatment for control of the more important pests, with details of experimental work, particularly in the use of malathion, Systox, and Isolan.

Lepidoptera

See also Nos. 3763, 4297.

4306. **Crop pests: shade trees, forestry etc.** *Rep. Dep. Agric. Nyasald. 1953/54*, Part 2, 1955 (43).

Reports a serious outbreak of borers, apparently larvae of a cossid, in pure stands of *Cassia siamea*. The same species is heavily infested with the giant coccid *Aspidoproctus pertinax*.

4307. GENT, J. **The cultivation of Ash in relation to *Prays curtisellus*, the Ash bud moth.** *J. Oxf. Univ. For. Soc.* (*Ser. 4*) No. 3, 1955 (9–13).

Studies of young trees on 3 sites near Oxford showed that: (1) most damage occurred at 4–6 ft., and none above 15 ft.; (2) straightening of the kink is achieved mainly by more vigorous diameter growth on the branch side of the stem, from the kink to 6–12 in. below, and reduced growth on the opposite side; (3) the rate of straightening is about 15°/inch of growth. Figures are given showing the total diameter growth required (2·0 to 5·2 in.) to straighten out initial angles of 20–60°.

4308. COPPEL, H. C., and ARTHUR, A. P. **Notes on introduced parasites of the European Pine shoot moth, *Rhyacionia buoliana* (Schiff.) (Lepidoptera: Tortricidae), in Ontario.** *Annual Report, Entomological Society of Ontario, Toronto* No. 84, 1953 (55–8). E.M.B.

Presents some data on parasite species raised, and releases and recoveries from 1928 to 1958.

4309. MILLER, W. E., and NEISWANDER, R. B. **Biology and control of the European Pine shoot moth [*Rhyacionia buoliana*, on *Pinus resinosa*].** *Res. Bull. Ohio agric. Exp. Sta.* No. 760, 1955. pp. 31. 30 refs.

Spraying with DDT at a concentration of 1–2 lb./100 gal. in mid-April, late June, or early July, gave good control. Red Pine plantations normally reach a stage in which the pest is no longer a matter of concern at 7–9 years. The number of sprayings necessary to control the insect during this period varies from 1 to 5.

4310. BOSELLI, F. Prove di lotta mediante elicottero contro il bombice dispari (*Lymantria dispar*) e il bombice gallonato (*Malacosoma neustria*) nelle sugherete della Sardegna. **[Control by helicopter of *L. dispar* and *M. neustria* in the cork groves of Sardinia.]** *Ann. Sper. agr.* (*n.s.*) 9 (3), 1955 [XVII–L). [It.] C.G.B.

An account is given of the successful control of these destructive pests of Cork groves by spraying with 5% DDT (petroleum solution or aqueous emulsion, at 12–15 litres/ha.) from a Bell 47 helicopter. The area treated amounted to 600 ha. Costs amounted to Lire 4585/ha. with petroleum and Lire 3571/ha. with water.

4311. TORRENT, J. A. **Oak tortrix and its control in Spain.** *FAO Plant Prot. Bull.* 3 (8), 1955 (117–21). I.M.I.

Quercus ilex, the typical climax forest species of three-fourths of Spain, is now reduced to one million hectares with 15–70 (mean 40) trees/ha. The life cycle and method of feeding of *Tortrix viridana* and its associates *Malacosoma neustria* and *Lymantria dispar* are described. Mean acorn yields were reduced by these 3 pests from 600 to 150 kg./ha. Details are given of the methods, costs and appliances tried in chemical control and of the factors affecting it. The recommended method is a light wheel-mounted duster using 1 kg./ha. of the active ingredient of DDT, made up to 10kg. with kaolin. A higher % of the *p-p'*isomer of DDT greatly increases the effectiveness, and should result in a 95–99% kill of *Tortrix*.

4312. WELLINGTON, W. G. **Weather and climate in forest entomology.** *Repr.* from *Meteorological Monographs, Boston* 2 (8), 1954 (11–8). 41 refs. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 67.)

Some basic references to the general field of insects and climate are provided, and some of the more recent research trends indicated. The reactions of two dissimilar species are described in detail, to show how field and laboratory observations lead to climatological investigations. The two species, the Spruce budworm, *Choristoneura fumiferana*, and the forest tent caterpillar, *Malacosoma disstria*, are both native to North America. Although active during the same part of the year, they have different physical requirements. For example, although both are adversely affected by prolonged rain, *M. disstria* develops better during moderately warm, humid, partly cloudy weather, whereas *C. fumiferana* develops best in dry, sunny weather. Hence, in areas where both occur, their outbreaks begin during different years, that, in each case, are preceded by a few years during which the specific favourable weather recurs. Before outbreaks of *C. fumiferana*, the area is influenced most by northern and western air, whereas, before outbreaks of *M. disstria*, it is influenced more by southern and southwestern air. In general, *M. disstria* outbreaks tend to begin in suitable parts of the boreal forest 2–4 years after the continental complex of storm

tracks has shifted northward, or after a marked increase in cyclonic activity. On the other hand, outbreaks of *C. fumiferana* tend to occur after southwards shifts of the tracks, or after decreased cyclonic activity. Several fields for further research are suggested, including a study designed to show effects of short-term climatic fluctuations on population trends of groups of insects occupying similar and dissimilar types of micro-habitats on a single tree species. *From author's summary.*

4313. BELYEA, R. M. **Death and deterioration of Balsam Fir weakened by Spruce budworm defoliation in Ontario. II. An assessment of the rôle of associated insect species in the death of severely weakened trees.** *J. For.* 50 (10), 1952 (729–38). 11 refs.

Fir mortality began in the 5th year of severe defoliation in the Lake Nipigon area, and was almost complete in the 8th year after the first attack. Ten species of bark- and wood-inhabiting insects were found to attack severely weakened or newly dead trees. Of these, only *Pityokteines sparsus* and *Monochamus scutellatus* were abundant and were observed to attack trees before death was obvious; even these did no real damage before death. [Cf. *For. Abstr.* 14 (No. 4537).]

4314. MILLER, C. A. **A technique for assessing Spruce budworm larval mortality caused by parasites.** *Repr.* from *Canad. J. Zool.* 33, 1955 (5–17). 21 refs.

4315. SMITH, C. C. **Tests of residual effect of DDT on newly-hatched Spruce budworm larvae.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 11 (2), 1955 (1).

The tests were made during a period of rather high rainfall, but they suggest that most of the residual effect of DDT is lost after 1–2 weeks. It seems that mortality of young larvae from residual effect of aerial spraying is likely to be slight, since hatching usually takes place 6–8 weeks after spraying.

4316. WEBB, F. E. **Aerial spraying against Spruce budworm in New Brunswick, 1954.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 11 (1), 1955 (1–2).

[Cf. *For. Abstr.* 14 (No. 1356); 15 (Nos. 1578, 3805).] Describes results in newly sprayed areas and on those sprayed in 1952 and 1953. It is concluded that spraying has kept alive large areas of forest that would otherwise now be dying. It has brought about a definite improvement in the condition of the trees in the year following spraying, which seems likely to be maintained for another year. Thus protection has been given for a period of 3 years, after which re-spraying may be necessary if the outbreak continues.

4317. DAVIAULT, L. **Aerial spraying against the Spruce budworm in Quebec in 1954.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 11 (1), 1955 (2–3).

In the early summer of 1954, ca. 318,000 acres of Balsam Fir forest in the Lower St. Lawrence region were sprayed with a 12½% solution of DDT at the rate of ½ lb. DDT in 1 gal. of solvent per acre, in order to save some valuable pulpwood stands. Study of sample areas (data given in some detail) indicated that the treatment was quite satisfactory, as it relieved trees of much of the pressure of budworm feeding and also reduced oviposition. This should enable the trees to survive without any further treatment, unless they are reinfested before the end of the outbreak.

4318. GRAHAM, K. **Notes on a polyhedral disease of black-headed budworm.** *Repr.* from *Canad. Ent.* 86 (12), 1954 (546–8). 1 ref. (*Contr. Div. For. Biol. Dep. Agric. Can.* No. 163.)

A polyhedral disease was found to be one of the natural agents reducing populations of *Peronea variana* in British Columbia during 1940–45 [cf. *For. Abstr.* 7 (No. 970)]. Observations are presented on some symptoms and microscopic characteristics of the disease.

4319. SAGER, S. M. **Virus disease in western tent caterpillar (*Malacosoma pluviale*).** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.*11 (2), 1955(3).

Polyhedral virus infection continues to increase in both field collections and insectary material.

4320. RUBERU, T. R. A. **Defoliator of *Albizzia lebbek: Eurema hecabe simulata.*** *Ceylon For.* (*n.s.*) 2 (1), 1955 (41–4). 8 refs.

A general account.

4321. HUSSEY, N. W. **Some aspects of Pine looper outbreaks.** *Coedwigwr* 2 (3), 1955 (77–82). 11 refs.

In view of the recent outbreaks of *Bupalus piniarius* in Great Britain, the author reviews the literature on some continental epidemics, with particular reference to the climatic conditions favouring the increase of *Bupalus* populations to epidemic proportions.

4322. ŠAROV, A. G. Iljmovyĭ nogohvost—vreditelj lesoposadok stepnoĭ zony. [***Exaereta ulmi*—a pest of forest plantations in the steppe zone.**] *Zoologičeskii Žurnal, Moskva* 32 (4), 1953 (594–607). [Russ.] From *abstr.* in *Referat. Ž.* (*Biol.*) 1954 (1) (No. 864). [Russ.] H.S.B.

Gives the results of studies in the Voroshilovgrad region, in 1951–53, of populations and life history of *E. ulmi.* In narrow strips of pure Elm (density 0·2–0·5), unfavourable to birds and to hymenopterous and dipterous parasites, there were 8 pupae/sq. in of soil, 1 egg/16 leaves and up to 30 larvae/tree, and the % of parasitization was low. In a broad mixed plantation (Oak/Elm/Ash with underwood of *Acer tataricum*; density 0·8–0·9), favourable to birds and parasites, no pupae were found and there were 1 egg/30 leaves, and 12 larvae/tree of Elm; 39% of the larvae were parasitized by *Apanteles xanthostigmus* and 48% by tachinids (e.g. *Winthemia amoena*, and more rarely, *Chaetocnema assimilis*), and more larvae were killed by predatory beetles, ants and birds. In the 4th instar, the larvae, previously indistinguishable, could be classified into 4 types differing in colour and other characters. Imagos bred from all types were identical. In pure Elm stands all larvae belonged to a type characterized by a yellowish-green coloration with dark stripes and spots, active habits, and a well developed fat-body

It was shown experimentally that this type develops only when larvae are reared in groups or subjected to mechanical stimulation, e.g. by larvae of another species or by fragments of wood. The occurrence of a high % of well nourished larvae of this type may therefore serve as an indication of a mass outbreak. The author suggests that in pure Elm stands any coppice or sucker growth should be cut and an underwood of *A. tataricum* and *Lonicera tatarica* planted.

4323. **Incidence and biological details of the fall webworm in 1954**. *FAO Plant. Prot. Bull.* 3 (5), 1955 (77–8). I.M.I.

Covers the development of the *Hyphantria cunea* epidemic (1953–5) in Jugoslavia and the work being done, through the Commonwealth Institute of biological control, Ottawa, in introducing parasites.

4324. Vité, J. P., and Kliefoth, R. Erfahrungen mit dem Buchenrotschwanz. [**Experience with *Dasychira pudibunda***.] *Holz-Zbl.* 81 (39), 1955 (511–2). 22 refs. [G.]

The recent mass outbreak of *D. pudibunda* in Central Europe terminated in 1954. Information is presented on the insect, its frass, epidemiology, natural enemies, damage, and control, based either on the 22 references quoted or on recent observations. The food-requirements ratio of egg larvae, last instar but one, and last-instar larvae is ca. 1/100/25. The pest seems to be favoured by certain climatic conditions rather than certain localities. The hours of most intense frass production were ca. 10 a.m.–4 p.m. The most serious causes of mortality in the pupal stage were fungi and unknown factors (probably polyhedral disease). Mice and birds (titmice) devour many pupae during hibernation. The pest is not a serious danger, and chemical control is not advisable.

4325. O'Dell, W. V. **The gypsy moth outbreak in Michigan**. *J. econ. Ent.* 48 (2), 1955 (170–2).

Describes the successful emergency spraying of 86,400 acres with 59,000 gal. of insecticide in 3 weeks.

Coleoptera

See also Nos. 3753, 3761–2, 3809, 4041, 4177, 4714.

4326. Weeraratna, W. G. **Hymenopterous parasitism of bostrychid wood borers**. *Ceylon For.* (*n.s.*) 2 (1), 1955 (27–9). 6 refs.

Describes a case of successful parasitization of *Heterobostrychus aequalis* by *Spathius* sp.

4327. Guillemain-Gouvernel, J. Sur l'identification de la substance de croissance provoquant les tumeurs des chênes attaqués par *Agrilus biguttatus* Fab. (Coleopt. Buprestidae). [**The identification of the growth regulator causing tumours in Oak attacked by *A. biguttatus***.] *Repr.* from *C.R. Acad. Sci., Paris* 236, 1953 (978–9). 3 refs. [F.f.]

Paper-chromatographic examination of the alcoholic extract of diseased parts showed that 2 substances were involved. [Cf. *For. Abstr.* 15 (No. 3816).]

4328. Lange, W. H., and Carlson, E. C. **Zonal dispersion of chemicals in soil following several tillage methods**. *J. econ. Ent.* 48 (1), 1955 (61–7). 3 refs.

Using bioassay and colour tests, the incorporation and persistence of lindane (2), aldrin (10), dieldrin (5) and DDT (20 lb./acre) in a clay-loam after spike-tooth harrowing, rotary tillage and disking, were studied in soil samples lifted from the top and second 2½ inches, after 7 and 148 days. The distribution by harrowing was the most unequal, the other cultivation methods being of about the same efficiency. Lindane and aldrin under the experimental conditions (strength applied etc.) were the most effective in wireworm (*Limonius canus*) control.

4329. Nakahara, J. [**Studies on the Sugi leaf beetle, *Basilepta pallidulum* Baly. I. Morphological studies.**] *Bull. For. Exp. Sta. Meguro, Tokyo* No. 76, 1954 (15–20). [Jap.e.]

Contains 17 drawings detailing the morphology of egg, larva, pupa and imago.

4330. Reymond, A. Description de deux formes nouvelles de Cérambycides du cèdre au Maroc, suivie d'observations sur la biocénose de cet arbre en Afrique du Nord. [**Description of two new forms of Cerambycidae on Cedar in Morocco, followed by observations on the biocoenosis of this tree in North Africa.**] *Bulletin de la Société des Sciences naturelles et physiques du Maroc, Rabat* 33 (4), 1953 (199–205). 9 refs. [F.] L.S.

The forms described are *Leptura otini* var. *peyerimhoffi* and *Rhagium inquisitor* var. *cedri*.

4331. Jover, H. Notes biologiques sur quelques coléoptères xylophages de Basse-Côte-d'Ivoire, Cerambycidae. [**Biological notes on some wood-eating beetles in the Lower Ivory Coast, Cerambycidae.**] *Rev. Path. vég.* 32 (4), 1953 (258–75). I.M.I.

Includes, for each of 26 species, the biology, parasites, commensals, damage, distribution and host tree species. Of these last, > 50 (some important) are listed. Most are attacked after felling. *Coptops aedificator*, *Zographus regalis* and *Acmocera compressa* are abundant and polyphagous. *Prosopocera bipunctata* may prove a serious pest in plantations of *Tarrietia utilis*. The larva (4 × 1 cm.) tunnels in the base and roots of trees < 15 cm. diam., affecting 10% of the stems, though more than one larva was never found in a stem. Uprooting and burning are recommended. [Cf. *For. Abstr.* 11 (No. 169).]

4332. Waters, W. E., McIntyre, T., and Crosby, D. **Loss in volume of White Pine in New Hampshire caused by the White Pine weevil**. *J. For.* 53 (4), 1955 (271–4). 3 refs.

Using the net merchantable volumes of the 1948 Forest Service enumeration as datum, the calculation of losses in potential merchantable volumes is detailed. These comprise 13% for pole timber (35 million cu. ft.); 40% for the sawlog part of sawtimber (2·16 thousand million bd. ft.); and 70% of the material below sawlog specification in the sawtimber (116 million cu. ft.).

4333. TOOKE, F. G. C. **The Eucalyptus snout-beetle *Gonipterus scutellatus* Gyll. A study of its ecology and control by biological means.** *Entomology Memoirs, Department of Agriculture, Pretoria* No. 3, 1955. pp. 282. 37 refs.

This monograph deals in detail with the history of the snout-beetle from its introduction into S. Africa (1900–1916) up to the importation in 1926 of the mymarid egg parasite *Anaphoidea nitens* and with the latter's gradual assumption of control, season by season, from that date. A table classifies the susceptibility of ca. 100 species of Eucalypt to beetle attack before the arrival of the parasite. The Ash Eucalypts and the allied Stringybarks, Ironbarks and Bloodwoods, as well as the *E. ovata*, *E. saligna* and *E. coriacea* groups were relatively or completely immune. Changes in the normal (Australian) seasonal cycle of the beetle and variations in the flushing of the young foliage of the host plant are referred to the variations in temperature and rainfall of the various climatic regions of S. Africa. The beetle, which will oviposit only on young foliage and which requires the stimulation of rain to emerge from its pupa in the soil, is forced in the summer rainfall areas to hibernate from a few weeks in the low to a few months in the high altitudes, with a consequent loss of opportunity for the egg parasite, the overwintering adults of which get so reduced that the first seasonal generation of beetle larvae, only lightly parasitized, may do conspicuous damage. The climate of the S. and S.W. Cape is like that of S.E. Australia the home of both beetle and parasite, and here the earliest control was attained. In the summer-rainfall areas below 4000 ft., economic control of all species of Eucalypt took 3–5 years. Above that altitude 5–15 years was required in some areas but elsewhere no economic control on *E. viminalis*, *E. maideni* and *E. globulus* (out of 65 species planted) has yet been achieved. It is claimed that such biological control on a subcontinental scale (as contrasted with island successes) is an outstanding achievement. The further planting of *E. viminalis* and possibly *E. insizwaensis* is considered unwise.

4334. LEKANDER, B. Skadeinsekternas uppträdande i de av januaristormen 1954 drabbade skogarna. **[Occurrence of harmful insects in the forests hit by the storm in Jan. 1954.]** *Medd. SkogsforsknInst., Stockh.* 45 (3), 1955. pp. 35. 7 refs. [Sw.g.]

Gives tabulated data and maps showing the extent of the wind damage, and results of a survey in the summer of 1954 on the different insects present and the damage to Scots Pine and Norway Spruce (classed as wind-thrown, wind-broken, timber, tops, cull butts and high stumps) by *Blastophagus piniperda* and *B. minor* and by *Ips typographus* and *Pityogenes chalcographus* respectively, on sites undisturbed or partly or wholly cleared since the storm, in different parts of Sweden. On the basis of these results, predictions are made on the probability of mass outbreaks in 1955; the danger of these is greatest in the more northerly parts of the storm-damaged area, N. of Lake Mälaren, in partly cleared areas, where unbarked timber, cull butts etc. were left lying throughout the autumn and winter. Control measures recommended are the use of poisoned trap trees and spraying unbarked timber with a 2% solution of Gesarol 50 [DDT] either of individual logs or, for less complete protection, of the timber stacks. Some details of costs are given.

4335. HUSSON, R., and STAUDER, F. Lutte chimique contre le scolytide de l'épicéa '*Dendroctonus micans*' Kug. **[Chemical control of *D. micans*.]** *Rev. for. franç.* 7 (7), 1955 (534–8). 10 refs. [F.]

Describes an outbreak of *D. micans* on Sitka Spruce (42 years old) in Saarland. Seven badly infested trees were treated with 'Mobe T' (a BHC compound manufactured by E. Merck of Darmstadt). The insecticide was applied to the infested roots (excavated for the purpose) by knapsack sprayer, and effected complete control. In addition to killing adult beetles, the insecticide dissolved resin deposits in galleries so that eggs and larvae were killed. Two or three heavy applications at short intervals are necessary to ensure control. [Cf. *For. Abstr.* 15 (Nos. 3822–5).]

4336. **Residual-type sprays differ widely in toxicity to bark beetles.** *Rep. Calif. For. Range Exp. Sta. 1954* [1955] (30–1).

In standardized tests on 4 insecticides, relative toxicity was, in descending order: (1) to Western Pine beetle—isodrin, lindane [γBHC], DDT and toxaphene; (2) to California five-spined engraver—lindane, isodrin, DDT and toxaphene. All four were much more toxic to the engraver than to the Western Pine beetle. In the field other factors not yet studied may alter their relative effectiveness.

4337. FURNISS, M. M., and HALLIN, W. E. **Development of high-risk trees in Ponderosa and Jeffrey Pine stands following sanitation-salvage cutting.** *For. Res. Note Calif. For. Range Exp. Sta.* No. 94, 1955. pp. 2.

In compartments from which trees most susceptible to barkbeetle attack had been removed in 1937–38, high-risk trees averaged 1110 bd. ft. or 1 tree/acre in 1954 as against 3000 bd. ft. or 2 trees/acre before the sanitation/salvage felling.

4338. **Tree vigor and Douglas-Fir beetle attacks.** *Rep. Intermt. For Range Exp. Sta. 1954*, 1955 (10–1).

A study on 186 beetle-infested and 920 adjacent non-infested trees in 4 national forests indicated that low-vigour trees are most susceptible to attack under endemic conditions but that high-vigour trees may be equally susceptible in epidemic conditions. [Cf. *For. Abstr.* 13 (No. 1393).]

4339. WALTERS, J., and CAMPBELL, D. K. **Mites as agents of natural control of the Douglas Fir beetle.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 11 (1), 1955 (3–4).

Experiments showed that mites effect a high degree of control on the immature stages of *Dendroctonus pseudotsugae*. Species of mite involved were *Calvolia* sp., *Dendrolaelaps quadrisetis*, *Lasioseius* sp., *Parasitus* sp. and *Uropoda* sp.

4340. HARRIS, P. ***Pseudohylesinus nebulosus* (Leconte): a study of the life history of the Douglas**

Fir *Hylesinus* in the North Okanagan. *Proc. West. For. Conserv. Ass. 1954*, 1954 (16–9). 4 refs.

The study was made on 12 Douglas Firs at Kamloops, British Columbia. It is concluded that *P. nebulosus* in this area has only one flight, one brood and one generation a year. It is readily adaptable to climatic variation, there are many local adjustments in the life cycle, and the species covers a large geographic area (from British Columbia to New Mexico).

4341. CHAPMAN, J. A. **Survival of *Trypodendron* sp.** *Bi-m. Progr. Rep. Div. For. Biol. Dep. Agric. Can.* 11 (2), 1955 (3–4).

This beetle overwinters as an adult, and information was desired on its survival after spring flight has commenced but before attacks have taken place, at outdoor temperatures normal for that time of year in British Columbia. Experiments indicate that under normal conditions in spring and early summer, with alternations of warm and colder weather and considerable moisture, some of the beetles may still be able to attack 4 weeks or more after the initial spring flight.

4342. KOIZUMI, C. **[Studies on the Todo-Fir barkbeetle (*Polygraphus proximus* Blandford).]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (49–52). [Jap.e.]

Describes the egg-gallery in the inner bark. The number of eggs laid (y) was found to be correlated with the length of gallery in mm. (x) as $y = 0{\cdot}986\,x - 2{\cdot}986$.

4343. PRISYAZHNYUK [PRISJAŽNJUK], A. A. **Application of BHC for protection of Pine seedlings against larvae of forest insects.** *Vesci Akademii Navuk Belarus.S.S.R.* 1952 (3), (49–55). [Russ.?] From *abstr.* in *Chem. Abstr.* 49 (7), 1955 (4928). L.S.

Pine seedlings, roots of which were sprayed with BHC before planting, showed in the following 2 years a higher % of living plants and better growth than controls. The optimum effect was obtained by using 0·25 g. BHC/seedling (90% survival in the following year vs. 50% for controls). Less effective was spraying of the soil holes with 0·5–1 g. BHC/seedling or application of BHC directly to the soil at 4·5–9 g. BHC/0·49 sq. m. before planting. Application of DDT (1 g./seedling) was inferior (72% survival) to that of BHC. The protective effect of BHC continues for 2 years; in some instances controls were totally destroyed by larvae during this time.

4344. BRAMMANIS, L. Rotskadeinsekter och deras bekämpning. **[Insects damaging roots and their control.]** *Skogen* 42 (11), 1955 (206–8). [Sw.]

Chemical and biological measures for controlling *Melolontha melolontha*, *M. hippocastani*, *Amphimallon solstitialis*, *Phyllopertha horticola* and *Serica brunnea*.

4345. TROŠANIN, P. G. Povreždenie korneĭ bereskleta maĭskim hruščem. **[Cockchafer damage to roots of *Euonymus*.]** *Lesn. Hoz.* 5 (9), 1952 (70–2). [Russ.]

Tabulated results of an investigation on a heavily infested site show that, contrary to the general opinion, the roots of *Euonymus* are not immune to cockchafer damage, and that control measures need to be taken before planting it.

4346. SHENEFELT, R. D., LIEBIG, H. R., and DOSEN, R. C. **Protecting machine transplanted trees from white grubs.** *For. Res. Note Univ. Wis.* No. 17, 1954. pp. 3.

Describes the adaptation and fixing of an ordinary pressure-type knapsack to a planting machine, so as to spray the roots and ground just in front of the packing wheels with a chlorinated hydrocarbon insecticide such as aldrin, chlordane or heptachlor. The apparatus is simple, cheap, easy to work, easily installed or removed from any shoe-type planter, which can operate at the usual speed. Treatment with an aldrin emulsion at 0·5% concentration gave very good protection against chafer grubs. The sprayer might also be used for other purposes, e.g. applying a 'starter' fertilizer.

4347. MENON, K. D. **The rhinoceros beetle [*Oryctes rhinoceros*].** *Malay. Forester* 18 (2), 1955 (83–5 + 4 photos). 3 refs.

A short account of the life history and habits of this pest of many species of Palm. Damage is done by the adult beetle, the larva being quite harmless. Control is best exercised by keeping estates and compounds clear of vegetable refuse. Wet sawdust, in particular, is a favourite breeding ground, and sawmills can effectively assist in minimizing infestation by rendering their sawdust unsuitable.

Hymenoptera

See also Nos. 3764, 4297.

4348. HADLINGTON, P. **The leaf blister sawfly (*Phylacteophaga eucalypti*).** *Tech. Notes For. Comm. (Div. Wood Technol.) N.S.W.* 8 (1), 1954 (16–9).

Illustrated account of a leaf miner that defoliates open-grown or unthrifty Eucalypts. It has been recorded on 8 species of Eucalypt. In response to many requests for a suitable spray, a 0·05% concentration of Phosfone '20' (E605) is recommended. This concentration gave 14% mortality in 3, and 97·1% in 8 days. At double this strength the mortality in 8 days was 99·5%.

4349. BENJAMIN, D. M., LARSON, J. D., and DROOZ, A. T. **The European Pine sawfly on the Henderson State Forest, Illinois, with notes on its biology and control.** *J. For.* 53 (5), 1955 (359–62). 6 refs.

Gives notes on the introduction and spread of *Neodiprion sertifer*, its local life history, the preferred hosts, two local predators and the results of spraying with DDT (in unfavourable weather) and of infection with imported virus (successful).

4350. GRAHAM, A. R. **Biology and establishment in Canada of *Mesoleius tenthredinis* Morley (Hymenoptera: Ichneumonidae), a parasite of the Larch sawfly, *Pristiphora erichsonii* (Hartig) (Hymenoptera: Tenthredinidae).** *Rep. Quebec Soc. Prot. Pl. 1953*, 1955 (61–75). 24 refs. [E.]

Gives a general review of the introduction, establishment and recovery of *M. tenthredinis* in

Canada, and an outline of the life history and biology of the parasite.

4351. ***Megastigmus* flies attacking conifer seed.** *Leafl. For. Comm., Lond.* No. 8 (rev.) 1954. pp. 10. Price 6*d*.

Lists species found in imported seed, and British species and their hosts, gives a key for identification of adults, describes distribution and damage, and gives an account of biological control by parasites, notably *Amblymerus apicalis*.

4352. NITTO, M., and SHIMIZU, K. **[On the Chestnut varieties resistant to the Chestnut gall wasp (*Dryocosmus kuriphilus* Yasumatsu).]** *Bull. Tokyo Univ. For.* No. 47, 1954 (173–88). 6 refs. [Jap.jap.e.]

Gives a list (in Japanese) of 135 forms and varieties showing the amount of gall formation over 3 years and from past records. Of these, 46 were resistant. The highest incidence of oviposition (30–35%) was in the 9th to 15th bud from the top. Bud cast was similar in resistant and non-resistant types. Tall and vigorous trees showed more galls, and applications of fertilizers had no effect on resistance.

Diptera

4353. SACANTANIS, K. La forêt d'arganiers, le plus grand foyer naturel de la 'mouche des fruits' existant au monde. **[The *Argania* forest, greatest centre of fruitfly infestation in the world.]** *Compte rendu des Séances Mensuelles, Société des Sciences Naturelles et Physiques du Maroc* 1955 (2), (51–2), [F.]

Argania spinosa forms characteristic forests ca. 700,000 ha. in extent, where the annual rainfall is 120–410 (optimum 250) mm. Its abundant fruits persist for a long time, and more than 18 varietal types with their varying seasons of fruit maturation extend the opportunity for the Mediterranean fruit fly *Ceratitis capitata*. The larvae average 40 per fruit, which makes the *Arganietum* the greatest infestation centre of this pest in the world. Chemical control is excluded [for the protection of parasites?] but cultural measures [not detailed] are suggested. Braconid parasites of the genus *Opius* have been introduced.

459. *Other Animals*

See Nos. 4296, 4299.

48. INJURIES DUE TO UNKNOWN OR COMPLEX CAUSES

See also No. 4177.

4354. STONE, E. C. **Coniferous seedling survival.** *California Agriculture, Berkeley* 9 (2), 1955 (7, 15).

In the hope of determining the cause of unexplained mortality in nursery stock, seedlings (2 + 0 and 1 + 1) of *Pinus jeffreyi*, *P. ponderosa*; *Abies concolor*, *A. magnifica*, and *Pseudotsuga taxifolia* were lifted in the autumn, their roots pruned to a length of 5 in., planted in 1-gal. cans and kept in a greenhouse under favourable conditions. There were 5 samples of 10 each for each species. After 60 days they were washed out, for observation of their root development, replanted in the same cans and their survival observed after another 120 days. The seedlings all appeared to be healthy 60 days after planting, but when washed out of the cans a considerable number (ranging from 16% for *P. ponderosa* to 40% for *P. taxifolia*) showed failure in root development, and at the end of the further 120 days most of these were dead. The tops were dry and brown, and the needles had started to fall. Close examination of the seedlings that produced roots and of those that failed to do so, did not reveal any external morphological differences.

4355. **Pole blight of Western White Pine.** *Rep. Intermt. For. Range Exp. Sta. 1954*, 1955 (47–8).

Research during the year included the following: a study on lesions and physiological studies (details of both to be published elsewhere); inoculations with *Leptographium* sp., which showed that this fungus, or its isolates, is not the primary cause of pole blight; successful grafts of pole-blighted scions on healthy stocks; studies on soils and rootlet mortality; distribution surveys on the disease; and analysis of diameter and volume growth records in diseased stands.

4356. MCKENZIE, M. A. **Needle blight of Eastern White Pine.** *Trees, Cleveland, Ohio* 15 (3), 1955 (12).

During the early summer, a reddening of the new needles of *Pinus strobus* has been increasingly reported from all parts of Massachusetts. The tip is commonly killed and sometimes the whole needle is affected. No fungus or insect has been found consistently on all trees affected. Trees appear usually to recover naturally.

4357. CAMPANA, R. J. ***Corticium galactinum* does not cause White Pine needle blight.** *Plant Dis. Reptr.* 38 (4), 1954 (297–303). 11 refs. A.P.B.

Unsuccessful attempts were made to isolate *C. galactinum* from living and dead trees with which it had been reported to be associated. Attempts were also made to induce needle blight by inoculating roots of potted White Pine with pure cultures of *C. galactinum*. The incidence of needle-blight symptoms was greater among the controls. The study yielded no evidence to suggest that *C. galactinum* is the cause of White Pine needle blight.

4358. JACQUIOT, C., and VINEY, R. La graisse du chêne. **[Ring and helical swellings in the stem of Oaks.]** *Repr.* from *Rev. Path. vég.* 33 (2), 1954 (66–79). 5 refs. [F.f.]

The causes of *graisse* in Oaks require further investigation. At least two are involved. One, possibly of insect or fungal origin, remains unidentified; the other is undoubtedly honeysuckle (*Lonicera* spp.) which should be extirpated in the thicket and pole stage. Counts show that as much as 17% of the stems in an Oak stand may be affected. The degrade is unimportant in sawing but may be serious in veneer logs. [Cf. *For. Abstr.* 15 (No. 3816).]

4359. CAMPBELL, W. A., and MILLER, J. H. **Early defoliation of Post Oak in the southeast in 1953.** *Plant Dis. Reptr.* 37 (12), 1953 (628–9). A.P.B.

No definite cause could be found for deterioration in the foliage of *Quercus stellata* in N. Georgia and parts of N. and S. Carolina, though spring frost injury, leaf blister and an unusually high population of leaf-feeding insects probably contributed to the condition.

4360. Toole, E. R., and Huckenpahler, B. J. **Yellow Poplar dieback**. *Plant Dis. Reptr.* 38 (11), 1954 (786–8). A.P.B.

In a small area of dieback and mortality of *Liriodendron tulipifera* in the Tallahatchie Experimental Forest near Oxford, Miss., a species of *Myxosporium* was found fruiting on some recently killed twigs. A fungus, as yet unidentified, was isolated from the margin between living and dead tissue of diseased twigs, and produced cankers in inoculated stems. The disease may be associated with the occurrence of several years of drought in the area.

4361. Hepting, G. H. **A southwide survey for Sweetgum blight**. *Plant Dis. Reptr.* 39 (3), 1955 (261–5). 6 refs. A.P.B.

The term Sweetgum blight is used here to refer to the entire complex of crown deteriorations observed over much of the range of *Liquidambar styraciflua* in recent years. Results are presented of a survey to investigate the extent and severity of the disease. Its cause is not known and more than one disease may be concerned. Mortality on the whole has not been great. [Cf. *For. Abstr.* 14 (No. 2147).]

4362. Berry, F. H. **Investigations of possible causes of Sweetgum blight**. *Plant Dis. Reptr.* 39 (3), 1955 (270–2). 4 refs. A.P.B.

Inoculations of healthy trees by fungi isolated from diseased ones caused no blight symptoms to develop; no transmission of the disease to healthy trees resulted from grafting experiments; leaf analyses revealed no nutritional deficiencies, no correlation was found between nematodes and disease symptoms; root mortality in diseased trees was higher than in healthy trees, but no recognized pathogenic fungi were isolated from roots of diseased trees.

4363. Young, G. Y. **Progress of Sweetgum blight in Maryland plots in 1952–1954**. *Plant Dis. Reptr.* 39 (3), 1955 (266–9). 4 refs. A.P.B.

Neither fertilizer nor pruning experiments succeeded in arresting the progress of the disease.

5. FOREST MENSURATION. INCREMENT; DEVELOPMENT AND STRUCTURE OF STANDS. SURVEYING AND MAPPING

51. SYSTEMS AND UNITS OF MEASUREMENT

See No. 4388.

52. MEASUREMENTS OF STEM DIMENSIONS AND VOLUME OF TREES, STANDS, FORESTS AND TIMBER

See also Nos. 3945, 4118.

521. *Diameter (Girth) and Sectional Area*

See also No. 4386.

4364. Vuokila, Y. **The Finnish curve calipers**. *J. For.* 53 (5), 1955 (366–7). 1 ref.

Describes, with scale drawings, the construction and use of fixed-arm calipers for measuring breast-height and higher diameters. [Cf. *For. Abstr.* 4 (p. 134); 12 (p. 264).]

4365. Hampf, F. E. **Relationship of stump diameter to d.b.h. for Sugar Maple in the northeast**. *For. Res. Note Ntheast. For. Exp. Sta.* No. 42, 1955. pp. 3. 2 refs.

Presents on the basis of 1021 measurements, a graph from the equation d.b.h. = 0·910 (stump diam. u.b. in inches) + 1·609 (stump height in feet) − 2·271. [Cf. *For. Abstr.* 16 (No. 2022).]

4366. Hampf, F. E. **Relationship of stump diameter to d.b.h. for American Beech in the northeast**. *For. Res. Note Ntheast. For. Exp. Sta.* No. 43, 1955. pp. 3.

Presents, on the basis of 554 measurements, a graph from the equation d.b.h. = 0·686 (stump diam. u.b. in inches) + 1·711 (stump height in feet) − 0·220.

4367. Johnson, F. A. **Estimating past diameters of Douglas Fir trees**. *Res. Note Pacif. Nthwest For. Range Exp. Sta.* No. 112, 1955. pp. 3.

Past diameters o.b. can be obtained by subtracting total diameter growth for the intervening period (the sum of wood growth and bark growth) from present diameter. The relationship between bark thickness and diameter is apparently linear for trees 10 in. diam. and over. Equations based on statistical analysis of data from 452 trees over, and 75 trees under, 10-in. diam. are given for determining total diameter growth from measured wood growth.

4368. Spurr, S. H. **Estimates of future tree diameters**. *Mich. For.* No. 7, 1954. pp. 2. 2 refs.

Describes a method of estimating future d.b.h. from present double-bark thickness and past diameter growth u.b. at b.h. The last of these values is obtained from increment cores at b.h. The method is suitable for use with pole-size or small sawtimber trees.

4369. Avery, T. E. **Gross volume estimation using 'plotless cruising' in Southeast Arkansas**. *J. For.* 53 (3), 1955 (206–7). 2 refs.

The gross volumes of 6 out of 8 separate plotless cruises were within 10, and 2 were within 20%, of those got from 100% tallies in second-growth southern Pines. The method has advantages for the one-man crew getting gross volumes/acre or

totals by species for quick estimates in stumpage appraisal on small tracts, and for checking residual volumes after logging. [Cf. *For. Abstr.* 13 (No. 3197).]

4370. CROMER, D. A. N. **Techniques and instruments for the determination of basal area and volume per acre.** *Aust. For.* 18 (2), 1954 (86–92 + 1 photo). 8 refs.

Gives a brief account of the *Winkelzahl* method of determining basal area, and some results of tests carried out by the Forestry Commission of New South Wales to compare the efficacy of the method with 100% enumeration (mean difference in b.a. determination only + 0·1). Volume estimated from the *Winkelzahl* b.a. gave a % error of − 2·4 or − 2·7 compared with true volume (measured after clear felling), according to which of two volume tables was used. It is concluded that the method is adequate for all practical purposes, provided that a reasonably good volume table is available, or that sufficient sample trees can be measured to give accurate mean-tree volumes.

The various improvements to the original simple rod and plate are described—Relascope, Reflectorscope [cf. *For. Abstr.* 15 (No. 526)], Mirror Relascope [cf. *For. Abstr.* 14 (No. 1394); 16 (No. 4119)] and the *Baumzahlrohr* (employing an optical edge to cover half the covered field of a cylindrical tube—the semicircle covered by the wedge displaces the image of the tree by an amount depending on the diameter of the tree and its distance from the observer, as well as the refraction of the wedge). The author has improved on this last device by fitting identical wedges to each objective of an inexpensive low-power binocular. The instrument (illustrated) reduces to a minimum the number of border-line cases, there are no scale difficulties, and it is light and easy to use.

4371. BRUCE, D. **A new way to look at trees.** *J. For.* 53 (3), 1955 (163–7). 2 refs.

An illustrated note of optical devices for applying Bitterlich's principle and improving on his Relascope. These include simple prisms costing $1 each in 7 strengths (2 to 8 prism diopters) covering b.a. factors of 4·4 to 69·6; correction for slope; a telescope with decentred lens sawn in two; and adjustable strength prisms.

4372. SENDA, M., and MAEZAWA, K. **[On the measuring instrument of stand basal area by Bitterlich's method.]** *Misc. Inform. Tokyo Univ. For.* No. 10, 1955 (69–76). 10 refs. [Jap.e.]

Describes the method and a modification of the instrument, which substitutes for the cross-arm a vertical slit equal to it in width. Through this a direct view is got of the tree at breast height, whatever the slope. Measurements carried out in 7 stands of conifers on slopes of 15–30° are compared with those got with the unaltered instrument.

522. *Height, Length*

See Nos. 4118, 4422.

523. *Bark*

4373. KORSUŇ, F. Síla kůry jako funkce tloušťky kmene. **[Bark thickness as a function of stem diameter.]** *Les, Bratislava* 2 (1/2), 1955 (51–4). [Cz.]

Bark thickness depends not only on stem thickness but also on age, site quality and other factors. For *Pinus sylvestris* the correlation between bark thickness (K) and stem thickness (D) is very poor, because of the very thick bark at the butt end. The author measured D and K in 1202 *Picea abies*, 1809 *Fagus sylvatica* and 1210 *Quercus robur* logs; the mean D and K, for these species were respectively: 25, 0·58; 33, 0·44, and 37, 1·24 cm. The smoothed curves of the K/D relationship are best represented by the equation $K = D/(a + bD)$, where a and b have the following values: Spruce, 2·6775, 0·060508; Beech, 5·4487, 0·055417, and Oak, 2·0913, 0·020738, when D is measured in cm. and K in mm. Two tables give the correction value for (double) bark thickness to be applied to D.

524. *Determination of the Volume of Trees and Stands*

524.1. Principles of Volume Determination. Form (Taper)

4374. MATSUI, Z., OSANAI, T., BABA, K., and ANAZAWA, H. **[On the stem volume table of Todo-Fir plantations. (IX).]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (121–5). [Jap.jap.e.]

Based on the analysis of 22 *Abies mayriana* stems aged 22–40 years, equations are given for form factor against height and diameter; volume [?u.b.] against height and diameter; and u.b. volume against o.b. volume. A form-factor table is given by 2-cm. diameter classes (4–30) and by one-metre height classes (3–23).

4375. MATSUI, Z., OSANAI, T., and BABA, K. **[On the stem volume table of Norway Spruce plantation. (X).]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (126–31). [Jap.jap.e.]

Based on the analysis of 32 *Picea abies* stems aged 23–45 years, growing in Hokkaido, equations are given for form factor against height and diameter; volume u.b. against height and diameter; and u.b. volume against o.b. volume. A form-factor table is given by 2-cm. diameter classes (2–30) and by one-metre height classes (3–23).

524.3. Volume of Tree Groups and Stands

See also Nos. 4369–70, 4374–5, 4390.

4376. CARVALHO, J. SILVA. Cubagem de povoamentos florestais. **[Volume estimation of stands.]** *Ediç. Prop. Serv. flor. Est. S. Paulo* No. 43, 1953. pp. 15 + 4 tbls. + 5 gphs. + 2 dgms. 2 refs. [Port.]

Reviews various methods of volume estimation of stands, recommends the mean tree method as most suitable for Brazilian stands, and presents some data obtained in São Paulo State by this method for *Cupressus lusitanica*, *Schizolobium excelsum* and *Eucalyptus saligna*.

4377. HUMMEL, F. C. **The volume/basal-area line: a study in forest mensuration.** *Bull. For. Comm., Lond.* No. 24, 1955. pp. 84. 22 refs.

The term 'volume/basal-area line' is used to denote the relationship that exists between the volumes of

trees and their sectional areas at breast height [cf. *For. Abstr.* 12 (No. 2481)]. Part I of the Bulletin, which deals with this relationship when the trees are taken from different stands scattered throughout a country, describes the use of the volume/basal-area line in the preparation of general volume tables. The recently published volume tables for coniferous species in Great Britain are used as examples to illustrate the procedure. Part II deals with the volume/basal-area line within a stand. After discussion of the errors to which the line is subject, its variation with species, age, site, and thinning treatment are examined. The main outcome of this part of the investigation is the general tariff tables (discussed in Chapter VI and reproduced in an appendix). The methods described in the present paper, of preparing and applying general tariff tables (series of related volume tables based on g.b.h. alone) differ from the methods described elsewhere. *From author's summary.*

4378. EMROVIĆ, B. O konstrukciji jednoulaznih tablica—tarifa—pomoću logaritamskog papira. **[Construction of single-entry volume tables (tariffs) with the aid of double logarithmic paper.]** *Šum. List* 78 (8), 1954 (386–92). 8 refs. [Croat.e.]

In connexion with Stoffels's work [see *For. Abstr.* 14 (No. 2518)] and the application of logarithmic paper for the construction of local volume 'tariffs' based on diameter alone, a special modified logarithmic paper is recommended to give a straight volume/diameter line. The ordinate (volume in cu.m.) is an ordinary logarithmic scale, while the abscissa scale obeys the equation $X = \mu$ [log $d + \frac{1}{2}$ log (log d − log 6·5)], where d is d.b.h. in cm., and μ a constant (scale modulus).

4379. POLYCARPOU, A. **Multiple standard volume table for *Pinus brutia*.** *Tech. Pamphl. For. Dep. Cyprus* No. 13, 1954. pp. 3 + 11 tbls.

4380. POLYCARPOU, A. **Provisional general volume tables for Troodos Pine in Cyprus (*P. nigra* var. *caramanica* Rehder).** *Tech. Pamphl. For. Dep. Cyprus* No. 16, 1954. pp. 1 + 9 tbls.

Give vol. in the round o.b. to 3 in. top diam. per inch g.b.h. and 5 ft. total height.

4381. POLYCARPOU, A. **Standard volume tables for *Populus nigra* L. 'Kavaki' in Cyprus.** *Tech. Pamphl. For. Dep. Cyprus* No. 14, 1954. pp. 1 + 5 tbls.

4382. YOUNG, H. E. **Volume tables for Maine.** *Misc. Publ. Me. agric. Exp. Sta.* No. 624, 1955. pp. 36.

Includes tables for *Thuja occidentalis*, *Tsuga canadensis*, *Pinus strobus*, *Picea* spp., and hardwoods.

4383. HOWROYD, C. S., and ALABAZO, J. C. **Volume tables for standing timber. 1. Urat Mata [*Parashorea malaanonan*]; 2. Seraya Merah [*Shorea* spp.]; 3. Majau [*Shorea leptoclados*]; 4. Keruing [*Dipterocarpus* spp.]; 5. Kapur [*Dryobalanops lanceolata*].** *N. Borneo For. Rec.* No. 4, 1953. pp. 26 + 3 gphs.

524.6. General Surveys of Forests and Whole Tracts of Forest. Partial Enumeration Surveys, Timber Cruising

See also No. 3936.

4384. CARRON, L. T., and HALL, N. **National forest inventory: Beech Forest (Victoria) military sheet area—Western half.** *Aust. For.* 18 (2), 1954 (128–40). 8 refs.

The purposes, objectives, and prescriptions for a proposed National Forest Inventory of Australia prepared by an inter-state conference are outlined. Production of a forest map and the volume inventory of an area in Victoria on these prescriptions are discussed. The forest map, on 1 mile to 1 in. military map basis, shows forest types, stand size, height and density classes interpreted from air photos. The volume inventory was carried out by a stratified random procedure, using 1-acre rectangular plots as units. The project proved that the prescriptions for the proposed National Forest Inventory are practicable, and that a descriptive and statistical statement of the forest resources of a comparatively large and valuable area for which there is little information can be made available to a forest service, for planning at the resources level, in a relatively short time by a small but properly managed sample. *Author's summary.*

4385. LAWRENCE, P. R., and WALKER, B. B. **Methods and results of forest assessment using random sampling units in photo-interpreted strata.** *Aust. For.* 18 (2), 1954 (107–27). 13 refs.

[Cf. *For. Abstr.* 11 (No. 1531); 14 (No. 537); 15 (No. 4410).] The paper outlines the principles and methods used in forest assessment in Tasmania. Results from nine assessment projects using random plots in photo-interpreted strata are tabulated and discussed, and conclusions drawn therefrom. The arguments leading to the adoption of random sampling in Tasmania wherever possible are summarized. Sampling intensities of between 0·3% and 1·0% are normally used for areas > 4000 acres, and over-all sampling errors < 15% for gross bole, and 20% for sawlog, volume (at the 95% probability level) are usually obtainable with these intensities. The allocation of sampling units among the various height and density classes is discussed. Random plots are employed wherever possible, but in very dense forests with poor access, random strips are used and subdivided into plots. Sampling errors for gross bole volume are almost invariably lower than those for sawlog volume. The magnitude of the sampling error varies mainly with the number of sampling units measured, sampling intensity having relatively little effect for the examples quoted. There is a good indication that any reasonable increase in number of sampling units over 120 will not reduce the sampling errors much below 10% for gross bole and 16% for sawlog volume with normal stratification. A method of multiple stratification appears to reduce the sampling errors very considerably. Sampling errors for individual strata vary with the number of plots and with density class, being lower for the denser stands. It is considered that the most efficient methods of estimating

volumes on areas of a few hundred acres are by applying to them the results of assessments of similar forests in the neighbourhood, or by ocular estimates by experienced local staff. Measures of the efficiency of sampling methods are discussed, and it is shown that the allocation of sampling units among strata plays an important part. The photo-interpretation is shown to be reasonably consistent within the two project areas tested. The costs of assessment expressed in man-hours are discussed and it is shown that the maximum cost per million super ft. of sawlog timber on an assessed area is in the neighbourhood of £10. Checks of assessment results from felling records on four areas indicate that a very satisfactory degree of accuracy is being obtained. *Authors' summary.*

4386. RICE, E. L., and PENFOUND, W. T. **An evaluation of the variable-radius and paired-tree methods in the Blackjack-Post Oak forest [of Oklahoma].** *Ecology* 36 (2), 1955 (315–20). 9 refs.

An evaluation of the variable-radius [*Winkelzahl*] and paired-tree plotless sampling methods is presented. The standard for comparison was a complete tree census of a Blackjack/Post Oak forest with Blackjack (*Quercus marilandica*) and Post Oak (*Q. stellata*) as the dominant trees, and Hickory (*Carya texana*) and Black Oak (*Q. velutina*) as common secondary species. In the stand investigated, the Blackjacks were twice as abundant as the Post Oaks but had about the same total b.a. The variable-radius method was found to be unsuitable for obtaining data on frequency, since large trees were favoured by the sampling gauge. This method proved to be undesirable also for determining density, for the following reasons: (1) extra time is required in the field to estimate the diameter class of each tree sampled, (2) considerable time is required for calculations, and (3) the method is unsuitable for determining the density of saplings; but it proved very satisfactory for procuring data on b.a. The paired-tree technique proved to be useful for procuring data on density, frequency, and b.a. but was insufficiently accurate, owing, probably, to the small sample utilized. An augmented variable-radius method was chosen for future forest analysis. This consisted of the usual variable-radius technique for determining b.a., supplemented by 40 arm-length transects of 0·01 acres each for procuring data on density and frequency. The variable-radius sampling method furnishes data in such a form that the spatial distribution of the individuals of any given species in a stand can be determined readily. Knowledge of the type of dispersion is important in interpreting any other kinds of information obtained from the stand. All four common tree species sampled by the variable-radius method in the Blackjack/Post Oak forest were found to be randomly dispersed. [Cf. *For. Abstr.* 15 (Nos. 3873–4).] *From authors' summary.*

4387. CUTLER, D. D. **A permanent plot system of survey for the continuous inventory of Ponderosa Pine stands in the Southwest.** *J. For.* 53 (3), 1955 (186–9). 7 refs.

Operable if necessary by a 1-man crew, the method involves a random selection of plot centres from air photos (1:15–20,000), located and marked permanently. About these centres, trees ($\geqslant 11{\cdot}6$ in. d.b.h.) and poles (3·6–11·5 in.) are mapped and tallied in circles of 0·25 and 0·1 acre respectively, the former individually with number of logs, the latter by inch classes. Regeneration (1 ft. high to 3·5 in. d.b.h.) is counted in a 0·02-acre circle, mortality on a strip of 1 × 10 chains on a bearing. A facsimile of the tally sheet shows the gridded concentric circles for mapping the plot.

525. *Volume by Assortments. Merchantable Volume*

4388. RICHTER, A., SCHAUER, W., and THIELE, H. Untersuchungen über die Beziehungen zwischen Vorrats- und Erntefestmeter für die Kiefer. **[The relation between the overbark solid cubic metre measured in the standing tree and that of the felled log under bark.]** *Arch. Forstw.* 3 (3/4), 1954 (206–25). 25 refs. [G.g.]

[Cf. *For. Abstr.* 15 (No. 2773).] Using data obtained from enumerating and then felling 111 stands in all parts of the East German Republic, representing all site and age classes, the authors present, with detailed statistical argument, an approximate *Erntefestmeter* table for the direct calculation of the actual volume of Scots Pine timber u.b. from enumerations on standing trees. The table covers top heights of 6–35 m. by 1-m. classes and 5-cm. diam. classes from 8·5 to 57·5, the extension to 82·5 cm. requiring further data.

4389. SPURR, S. H. **Volume of the butt log.** *Mich. For.* No. 8, 1954. pp. 3.

The basic solution (assuming (*a*) 16-ft. logs, (*b*) bark thickness 10% of d.b.h., and (*c*) Girard form class of 80) gives the formulae $CF = 0{\cdot}0655\ D^2$ and $BF = 0{\cdot}60\ D^2 - 2{\cdot}45\ D$, where *CF* and *BF* are cu. ft. and bd. ft. volumes respectively, and *D* is d.b.h. o.b. in inches. Variants are given for varying values of (*a*), (*b*) and (*c*).

526. *Log Measurement. Scaling*

See also No. 4118.

4390. LYNCH, D. W. **What is an acceptable error and sample size in sample log scaling or tree measuring?** *Res. Note Intermt. For. Range Exp. Sta.* No. 14, 1954. pp. 3 + 2 sets of gphs. + 1 alinement chart. 2 refs.

Gives an alinement chart for determining the most economical allowable error in sample scaling and sample-tree measuring, and graphs showing the number of units in the sample needed for allowable errors of 2–5%, for sale sizes ranging from 500 to 20,000 units, and coefficients of variation of the material of 0·3 to 0·8.

4391. **Volume tables for round logs, quarter girth convention, issued under the Forest Ordinance, 1936.** North Borneo, Forest Department, Sandakan. 1952. pp. 16. Price $1·50 or 3*s.* 6*d.*

527. *Solid Volume of Stacked Products*

See also No. 4118.

4392. PALLAY, N. Vizgálatok a tüzifa átszámító kulcs megállapítására. **[Investigations for determining**

conversion factors for [stacked] fuelwood.] *Erdömérnöki Föiskola Közleményei Sopron, Budapest* 1954 (1955), (11–28). 4 refs. [Hu.russ.g.]

Revised factors, for stacks of mixed species 1·35 m. high, were obtained from xylometer readings as follows: cleft wood 0·77; round 0·76; stumps 0·54, based respectively on 229, 210, and 50 cu.m. stacked. Cleft wood averaged 60 and round wood 95 pieces/stacked cu.m.

4393. MARTIN, W. H. **How truck wood is measured at C.I.P.'s Hawkesbury mill.** *Paper Tr. J.* 139 (18), 1955 (16–9). 1 ref. P.R.

Describes methods adopted to measure hardwood pulpwood arriving at an average rate of 130 lorry-loads per day. The unit of measurement chosen was the cord, which was found to be equivalent to ca. 82 solid cu. ft. of rough hardwood (compared with 85 cu. ft. for softwood).

53. SPECIAL MEASUREMENTS OF TREES AND STANDS (CROWN DIMENSIONS, STAND DENSITY ETC.)

See also No. 3733.

4394. **[Crown and stem characteristics of conifers.]** *Rep. Calif. For. Range Exp. Sta. 1954*, [1955] (28).

Studies on the problem of tree breakage by wind produced curves [some of which are included] allowing close estimation of the dry weight of crown for 13 species when crown length and stem diameter at the base of the crown are known. The curves show that: (1) relative crown weight and tolerance [of shade?] are not necessarily correlated; (2) weight changes more rapidly with stem size for certain species; and (3) the relationship determined varies by site for Ponderosa Pine. Results can be used to predict the amount of slash that will be produced by different cutting methods. Data were obtained for estimating, with little loss in accuracy, the crown weight from d.b.h. alone.

4395. SARVAS, R. **Measurement of the crown closure of a stand.** *Commun. Inst. for. Fenn.* 41 (6), 1953. pp. 13. 11 refs. [E.fi.]

Describes Cajanus's cylinder, an instrument originally designed for the accurate drawing of tree crown projections, for which it proved too cumbersome, and explains its use for measuring crown closure. A number of spots are selected at random in the stand to be measured, and by means of the cylinder each is examined individually to see whether it remains inside or outside the crown projection of the trees. The % of spots inside the projection indicates the approximate crown closure values. A sample of 200 spots is recommended. The method resembles the Canadian 'Moosehorn' method [cf. *For. Abstr.* 9 (No. 1958)], but is more accurate.

54. ASSESSMENT OF SITE QUALITY

See also No. 3870.

4396. BROWN, J. M. B. **The assessment of site potentiality in the Chilterns.** *Abstr.* in *Quart. J. For.* 49 (2), 1955 (90–2).

Abstract of a paper read to the British Association in 1954 as part of a symposium on the Chilterns Project.

4397. RALSTON, C. W., and BARNES, R. L. **Soil properties related to the growth and yield of Slash Pine plantations in Florida.** *Proc. Soil Sci. Soc. Amer.* 19 (1), 1955 (84–5). O.R.E.

Soil samples were taken and tree measurements made in 269 Slash Pine plantations in an attempt to establish some relationship between soil characteristics and height growth. Relationship between height and age of the dominants and 12 soil variables were analysed by multiple regression methods. Functions of (1) depth of soil to a zone of mottling, and (2) depth to a fine textured horizon, showed a high degree of correlation with height growth. *From authors' summary.*

4398. AIRD, P. L., and STONE, E. L. **Soil characteristics and the growth of European and Japanese Larch in New York.** *J. For.* 53 (6), 1955 (425–9). 16 refs.

Of 8 site factors tested, the closest correlations with height growth at 25 years (stands 15–45 years) were with soil drainage class (*D*) and root room, i.e. the depth to a root-restricting layer (*RR*). These two soil characteristics were highly correlated with each other and with several other site factors, and consequently multiple regression equations proved only slightly more useful than simple regressions with depth or drainage, in providing guides for productivity estimates.

There was no indication that Japanese Larch was more tolerant of impeded drainage than European Larch. A table gives site class and mean site index for each species for soils grouped by *D* and *RR*.

4399. LEMMON, P. E. **Factors affecting productivity of some lands in the Willamette Basin of Oregon for Douglas-Fir timber.** *J. For.* 53 (5), 1955 (323–30). 37 refs.

Age and height were measured in upper-storey Douglas Fir in 310 unmanaged, even-aged, normally stocked forests, ranging from 20 to 207 years and situated at elevations < 2000 ft. Site factors were recorded in considerable detail. Regressions are calculated for the logarithm of total height against the reciprocal of age, soil depth, slope, elevation, annual and warm-season precipitation. The best estimations for site index are given in 3 equations, separately for two soil types, each grouped for aspect and position on the slope; two equations use soil depth and age, the third adds slope, elevation, and annual precipitation. Total effective soil depth was the most important factor and this is graphed against site index for a general curve and its fiducial limiting curves.

4400. SCHMIDT, R. L. **A method of estimating site quality of logged land in the coastal Douglas Fir belt of British Columbia.** *Res. Note B.C. For. Serv.* No. 27, 1954. pp. 7.

A study was made to determine the relationship of site quality, in terms of site index and forest associations, to diameter-increment measurement of stumps in cut-over forest. The latter was expressed by 3 arbitrary measures, viz. growth for 100, 150, and

from 100 to 150 years respectively. Data are given for 4 site indexes and 3 forest associations. For field application, 3 of the largest Douglas Fir stumps should be selected for ring counts, on an area of uniform site, avoiding abnormally large or excentric stumps. A table is given for making adjustment of age to allow for time required by the tree to grow from ground level to stump height. The method is not claimed to be exact, but serves as a convenient rough guide towards the mapping of cut-over land.

4401. **Some Aspen site factor relationships discovered.** *Rep. Lake St. For. Exp. Sta. 1954*, [1955] (12).

Analyses of 56 soil samples collected from good and poor stands indicated that productive *Populus tremuloides* sites generally have a moderately high content of soil organic matter, a fairly high content of silt and clay particles, a moderate to high content of nutrient elements, and often a high water table. Coarse-textured soils with a deep groundwater table and deficient in organic matter are usually poor sites. Such soils generally also have a relatively low pH and content of available nutrients. Removal of the organic layer in the soil by fire considerably lowers or reduces site quality.

56. INCREMENT. DEVELOPMENT AND STRUCTURE OF STANDS

See also Nos. 3857, 3860, 3905, 3939, 3943–6, 4050–1, 4075 *et seq.*, 4461, 4510.

561. *Increment in Height, Diameter, Basal Area, Form and Quality. Variations and Trends; Dendrochronology*

See also Nos. 4367–8.

4402. BAUCK, R., and BROWN, R. M. **Sharpening an increment borer.** *Minn. For. Note* No. 39, 1955. pp. 2.

Illustrated by 6 photos.

4403. MAMMEN, E. Der Einfluss einiger Witterungsfaktoren auf Jahrringbreite und Spätholzbildung verschiedener Holzarten des gleichen nordwestdeutschen Standortes. **[The influence of some climatic factors on annual ring breadth and late-wood formation in various species on a single site in N.W. Germany.]** Dissertation, Forstliche Fakultät der Univ. Göttingen, Hann. Münden. [1952?]. pp. 129. 60 refs. [G.g.]

Gives the results of a study on 2 trees each of Austrian Pine, European Larch, Norway Spruce, Pedunculate Oak, Red Oak and Ash, and 1 each of Weymouth Pine, Douglas Fir and Beech, all on a small area near Oldenburg selected to eliminate soil variations as far as possible. The growth record studied covered ca. 35 years, the trees varying from 50 to 160 years old. Mayer-Wegelin's 'hardness feeler' was used to investigate the distribution and relative hardness of early (e.w.) and late wood (l.w.) within the rings. Clear correlations were found in most cases between ring breadth, proportion of l.w. and hardness of l.w. on the one hand, and seasonal precipitation and/or temperature on the other. Spruce was especially sensitive to such factors, and Beech showed the poorest correlations. Species varied *inter se* in their individual reaction to particular factors. Where 2 trees of a given species were available, their reactions were uniform. The proportion (*a*) and hardness (*b*) of l.w. showed better correlation with climatic factors than the corresponding values for e.w. For l.w. (*a*)—being closely correlated with radial increment—varied in the same sense as precipitation and temperature, whereas (*b*) varied positively with summer temperature and often negatively with summer precipitation.

4404. HOLMSGAARD, E. Årringsanalyser af danske skovtræer. **[Tree-ring analyses of Danish forest trees.]** *Forstl. Forsøgsv. Danm.* 22 (1), 1955 (1–246+3 folding gphs.). 8 pp. of refs. [Dan.dan.e.]

After a brief historical review of literature, the author deals with the material studied—chiefly Beech and Norway Spruce, but also some Oak (*Quercus robur*), Ash (*Fraxinus excelsior*), Alder (*Alnus glutinosa*), Silver and Douglas Firs, Sitka Spruce, Scots Pine and *Juniperus communis*, all grown in typical well-tended forests, in even-aged, mostly pure, stands. In all, the rings measured numbered 37,300 for Beech, 10,400 for other deciduous species, 25,600 for Norway Spruce, and 4700 for other conifers. The methods used are described; they are based on previous work by Ruden and by the author [see *For. Abstr.* 7 (No. 2098); 8 (No. 1473)], particularly in the finding that ca. 50 increment cores from 6–8 stands will give a satisfactory expression of climatic influences on growth in a given locality (though in the present work only 2 stands each of Douglas and Silver Fir and 1 of Juniper could be sampled). Datings were verified by cross-dating, and after suitable corrections for age etc., a mean 'ring index' was found for each locality, expressing the corrected mean ring breadth of the individual year in % of 'normal' (taken as the mean of the corrected values for 1900–1949). Estimates are made of the accuracy of the indices obtained.

A special study was made in 1 Norway Spruce and 2 Beech stands of ring-index variations at different heights in the stem; these were found to be very uniform at all heights in Spruce and for the lowest $\frac{1}{2}$–$\frac{1}{3}$ of the Beech stems (where most of the increment is put on), so that the ring indices may be taken as a good measure of volume increment in the former species, and as fairly good for the latter.

The effect of thinnings on the ring index is discussed and dismissed as insignificant under the conditions represented and the method of sampling used. Seedbearing, however, was found to have a pronounced effect in Beech, greatly reducing the ring index of stands $\geqslant$ 100 years old in a mast year (in heavy mast years a reduction of ca. 50% is noted for 130-year stands) and for at least the two succeeding years. This reduction appeared to be greater in the upper part of the stem. For Norway Spruce, less information was available, but there appeared to be a corresponding reduction of at least 25–30% in heavy seed years and possibly a reduction for a few of the succeeding years. For future studies of climatic effects on ring breadth it

therefore seems desirable to base the work on younger stands, especially for Beech, since the effect of seedbearing may outweigh that of climate. Insect and fungus epidemics on Beech and Norway Spruce in Denmark are too rare to mask any climatic effect on increment, but the situation may well be different for e.g. Oak and Douglas.

In a special study of possible provenance effects for the exotic Scots Pine and Norway Spruce, the incidence of the chief maxima and minima of ring breadth as between different provenances was found to be very uniform. In Spruce, ring variations of provenances from neighbouring regions were much more uniform than those of Spruce from widely separated regions. The differences, however, were too small to affect the interpretation of data for unknown provenances as regards climatic effects.

Site showed little effect on ring variations in Beech: in Norway Spruce, the variations were almost always greatest on the poorest sites. The variations also generally increase with increasing stand age: for Beech, this is probably connected with the effects of seed years, but data for other species permit no conclusions on this point.

A small-scale investigation of exposure effects on Beech indicated that (*a*) varying wind conditions in different years affected ring breadth in trees at the exposed margin of a stand more than in those inside it; and (*b*) it would be unsafe to make inferences on ring variations in stands from variations in open-grown trees.

Ring indices can be used to correct data in increment studies: for an individual sample plot the random errors in measurements are so large that such correction would not be worth while, but where simultaneous measurements are made of several plots, these errors should be so much reduced that correction by ring indices would be advantageous.

Comparison of ring indices and meteorological factors by correlation analysis showed that May–July rainfall was of great importance for growth in the same year of nearly all species studied, but June–Sept. temperature only for Oak, in which some correlation was also found with temperature of the preceding autumn. Some species, notably Alder, Douglas, and Sitka Spruce, reacted unfavourably to Jan.–April temperature, probably owing to the effect of a cold soil on water uptake in spring. The weather of the preceding year, as indicated by the increment for that year, also showed significant correlation with the current year's increment in most species. For Norway Spruce the data permitted estimates to be made of the effect of a ± 10-mm. rainfall deviation from the average, in the preceding year, on the volume increment of the current year. These figures indicate that the relative variations in increment are greatest on the poor sandy heaths, and on a rich clay (where the effect of available water is probably evident because nutrients are not a limiting factor). The susceptibility of Norway Spruce to drought on these soils may well explain its poor health there.

The material was insufficient to correlate long-term climatic effects on ring indices, except for Beech, in which the post-1880 data agree ($r = + 0{\cdot}75$) with the formula: $L_{10} = - 25 + 1{\cdot}25P_{10}$, where L_{10} = mean ring breadth of a 10-year period and P_{10} = mean May + June + July rainfall for the same period, both in % of the corresponding means for 1900–1949.

Tables and figures have English legends, and there is a 10-page English summary.

4405. Eklund, B. Årsringsbreddens klimatiskt betingade variation hos tall och gran inom norra Sverige åren 1900–1944. **[Variations caused by climate in annual-ring width of Pine and Spruce in N. Sweden, 1900–44.]** *Medd. SkogsforsknInst., Stockh.* 44 (8), 1954. pp. 150. 42 refs. [Sw.sw.e.] Price *Kr.*8.

Increment cores were taken from 2079 Pines and 2658 Spruce in, respectively, 131 and 199 sample plots in N. Sweden laid out in unthinned stands. Mean annual-ring widths were calculated from at least 10 representative sample trees of the species per plot and the values for each calendar year from 1900 to 1946 were plotted, to give an annual-ring series. Adjustments were made, employing regression analysis, in order to eliminate the effect of decrease of annual-ring width with age, giving an 'annual-ring index' (*I*), which is independent of the absolute ring width and constitutes an approximate expression for the calendar year's property as a good or bad growing year as regards diameter increment, an *I* value of 100 representing a normal year. The graph of the *I* series for Pine shows a comparatively undulating line, much more so than that for Spruce. Comparison with *I* series for the two species in Finland gives a higher correlation between annual-ring variations for Pine than for Spruce. The differences between the series of the two species may be attributed partly to the much larger effect of the immediately preceding growth periods on the amount of assimilating foliage, for Pine than for Spruce. A statistically reliable negative relation was found between cone yield and *I* of the same year for Spruce but not for Pine. *I* was found to be somewhat affected by local climate and latitude, but not by altitude, site class and crown density. The amount of soil water did not appear to affect the variations in *I*. It was not found possible to determine and reproduce numerically the effect of long-period climatic changes on *I* series.

4406. Schove, D. J. **Summer temperatures and tree-rings in North-Scandinavia A.D. 1461–1950.** *Repr.* from *Geografiska Annaler, Stockholm* 36 (1/2), 1954 (40–80). 53 refs. [E.]

562. *Volume Increment*

4407. Andrén, T. Produktionsmöjligheter på medelgod norrländsk skogsmark. **[Yield possibilities on average forest sites in N. Sweden.]** *Norrlands SkogsvFörb. Tidskr.* 1954 (4), (653–713). 13 refs. [Sw.]

Discusses characteristics of soils and climate, and results of measurements on 50 sample plots in 16- to 50-year-old planted Pine at or near 64° N. compared with yield tables for natural Pine in N. and S. Sweden.

4408. Meyer, H. A., and Bartoo, R. A. **Development of a managed upland Oak woodland in**

Pennsylvania. *Res. Pap. Pa. St. For. Sch.* No. 21, 1954. pp. 7.

A study of stand volume, structure and increment for 60 acres of farm woodland over 15 years.

4409. MEYER, H. A. **Mortality in two managed Oak forests in Central Pennsylvania.** *Res. Pap. Pa. St. For. Sch.* No. 20, 1954. pp. 2 + 2 tbls.

Tabulated data for average annual mortality (1) in % of initial cu. ft. volume in trees of 7 in. d.b.h. and over, and (2) by diam. classes in % of initial growing stock, for periods of 12 and 15 years.

4410. LUDVIGSEN, F. P. Tilvekstberegning efter prøvetrær bare for diameter og årringbredde. **[Calculating increment from sample trees, using only diameter and annual-ring breadth.]** *Tidsskr. Skogbr.* 63 (1), 1955 (17–26). [Nor.]

Further studies were made on the use of the simplified method already described for determining increment [see *For. Abstr.* 15 (No. 3872)]. The only direct measurements needed on sample trees are d.b.h. and the breadth of the last 10 annual rings. The necessary mean tree data (diam. u.b. in cm., volume/tree u.b. in cu. dm., and height in m.) for Spruce and Pine on site quality classes 2–4, in dense, medium or open stands, the d.b.h. over bark ranging from 12 to 42 cm., are given in tables based on measurements in 1000 farm forests. Further tables show the relationship of form-height increment % to b.a. increment %, the latter being obtained normally by Jonson's method. The use of these data should give a reasonably accurate estimate of increment in small forests.

4411. ČOKL, M. H kontroli gospodarjenja v enodobnih gozdovih. **[Control of management in even-aged stands.]** *Gozd. Vestn.* 13 (1/2), 1955 (1–14). 6 refs. [Sloven.sloven.g.]

Even-aged stands in Slovenia average 100,000 ha., or ca. ⅛ of the total forest area. In these, periodic enumerations are indicated so that their silvicultural conditions can be improved. Volume increment figures obtained for Spruce, Silver Fir and Pine on sample plots at Ljubljana, using Krenn's simplified volume tables [cf. *For. Abstr.* 13 (No. 3203)], were higher than those calculated by the 'tariff' difference method of Meyer; it is claimed that the fault lies with the latter method, which is based on static curves, whereas Krenn's tables are based on dynamic ones. It is suggested that the individual d.b.h. classes be considered as separate stands for determination of volume increment, applying Krenn's tables; in this case the increment % corresponding to a d.b.h. increment of 1 cm. has the same value for either method, irrespective of height (site quality, age). The increment % was also found to differ only slightly for different species. The author has consequently calculated a uniform increment % for each 1 cm. of d.b.h. increment for even-aged stands (Spruce, Fir, Pine, Beech, Oak, and an average) based on Krenn's tables, and for selection stands based on Biolley's 'tariffs', and has worked out a simple method of evaluating the volume increment from the increment % figures obtained. It is claimed that the method suggested is more accurate and simpler than Meyer's.

564. *Forecasting Increment*

See also No. 4368.

4412. ROY, D. F. **The Clements growth prediction charts for residual stands of mixed conifers in California.** *Tech. Pap. Calif. For. Range Exp. Sta.* No. 9, 1955. pp. 10 + 3 dgms. 5 refs.

Alignment charts are presented for estimating gross increment, recruitment, and loss in residual stands 11·6 in. d.b.h. and over in the Sierra Nevada, for a number of variables in stand condition immediately after logging.

4413. JOHNSON, F. A. **Predicting future stand volumes for young well-stocked Douglas-Fir forests: a comparison of methods.** *J. For.* 53 (4), 1955 (253–5). 3 refs.

Seven methods are compared, using data from 17 plots in localities ranging from the coast to the foothills of the Cascades and from the headwaters on the Willamette R., Oregon, to Puget Sound, Washington. Ages varied from 38 to 103 years; site index, 122–190; and stocking, 35–338 %.

566. *Yield Tables and Their Construction*

4414. WAUTHOZ, V. Rendements de l'épicéa dans ses cultures artificielles ardennaises. **[Yields of plantation-grown Norway Spruce in the Ardennes.]** *Bull. Soc. for. Belg.* 62 (5), 1955 (225–68 + 5 photos). [F.]

Tables show, for 4 quality classes, 5-year age intervals, and different thinning treatments: financial yield, rate of interest (annual and periodic), stand structure, intermediate and final yields.

4415. PATRONE, G. Tavola alsometrica dell' abete rosso di Borno cresciuto in fustaia coetanea. **[Yield table for even-aged Norway Spruce at Borno.]** *Ital. for. mont.* 10 (1), 1955 (39–42). [It.it.f.]

From 10 to 150 years, in 3 quality classes.

4416. MATSUI, Z., and SHINOHARA, H. **[On the treatment of secondary Birch stands in Nakashibetru district.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (146–53). [Jap.e.]

Contains a yield table for secondary Birch, which 14–30 years ago invaded abandoned fields along with Oak, Maple and Ash. The m.a.i. at 25 years is 4·1 cu.m. Three hectares of these stands would meet a farmer's fuel requirement, and with *Sasa* or *Carex* present, 50 [*sic*] cattle/ha. can be grazed. The stands also are useful as wind and fog-breaks.

4417. MATSUI, Z., and ONODERA, S. **[The growth and yield of Mizunara-Oak plantation in Nopporo experimental forest.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (132–45). [Jap.e.]

Contains 12 tables, including a yield table showing the growth of *Quercus crispula* planted 1916–18, the crops now containing 23–47 % by volume of Elm, Maple, Ash etc. Volumes at 37–40 years were 128–168 cu.m./ha. with m.a.i. 3·5–4·6 cu.m. Regression equations for height and diameter on age are given for two sites. The stands now require thinning.

4418. Matsui, Z., Moori, K., and Sasaki, M. **[The sociating and growing of natural stands on the bottomland in the Teshikaga region.]** *Spec. Rep. For. Exp. Sta., Hokkaido* No. 3, 1955 (154–61). 5 refs. [Jap.e.]

Stands of *Populus maximowiczii*, 4 kinds of Willow, Elm, Ash and Alder, aged ca. 31 years, carry volumes of 225–249 cu.m./ha. Regressions are given for height and diameter and number of stems/ha. in the main crop on age. A m.a.i. of 7 cu.m./ha. can be expected. A yield table is included.

58. SURVEYING AND MAPPING. AERIAL SURVEYS

585/588. *Aerial Reconnaissance and Survey*
See also Nos. 4286, 4384–5.

4419. Zahir-ud-Din, A. S. M. **Aerial survey of Chittagong Hill Tracts forests.** *Pakistan J. For.* 4 (4), 1954 (237–40).

The author found that aerial photographs taken with a 6-in. angle camera, on a scale of 3 in./mile were clear enough for a broad classification of vegetation by forest types. Identification and delineation of forest-type boundaries from stereoscopic study of aerial photographs, supplemented by sample enumerations on the ground, were expected to furnish data for an inventory adequate for preliminary forest planning. The principal species in these forests, Gurjan (*Dipterocarpus* spp.), when mature, have characteristic crowns that can be easily distinguished on photographs, and their distribution can be shown on the stock maps. Comparatively pure Bamboo forests, with a characteristic, uniform light texture and tone, could be similarly demarcated from the main timber belt in each valley.

4420. Spurr, S. H. **Photo-interpretation aids.** *Mich. For.* No. 3, 1953. pp. 3.

Notes on lens stereoscopes, reflecting stereoscopes, parallax devices, and area measurement (grids, overlap etc.), with names and addresses of manufacturers.

4421. Carow, J. **The University of Michigan photo-interpreters scale.** *Mich. For.* No. 6, 1955. pp. 2. 2 refs.

The photo-interpreter's scale is an assembly of a number of simple measuring devices (chain scale, micrometer wedge, dot wedge, crown closure scales, plot circles, scale of photo, inch scale, area grid and course grid) on a single piece of clear film. It is available in natural scales of 1 : 20,000 and 1 : 15,840 at $1·00 each.

4422. Aquino, R. R. **Glossy photographs versus positive transparencies for tree height measurements.** *Filipino For.* 5, 1953 (20–33). 8 refs.

Measurements made on glossy prints and positive transparencies from the same negative decisively proved the superiority of the latter.

4423. Heinsdijk, D. Bosbouwkundige fotointerpretatie. **[Interpretation of [aerial] photographs in forestry.]** *Publicatie van het Centraal Bureau Luchtkaartering te Paramaribo* No. 13, 1953. pp. 19 + 1 set of graphs. + 1 tbl. 36 refs. [Du.]

Stresses the value of aerial photography in determining forest type, and, to a lesser extent, species, in forests where ground survey is difficult. Compares data from ground and aerial surveys on the distribution of trees by crown-breadth classes. Presents graphs showing, from ground data from 17,868 trees of 13 Surinam species, the relationship of crown breadth to d.b.h., length of merchantable stem, and height of buttresses, and tables showing the distribution of d.b.h., tree and buttress heights, and merchantable volume by crown classes, and the relationship between volume of trees of the upper crown layer (visible on the aerial photographs) and total volume/ha. Discusses the determination from photographs of the volume and composition of forests by species, and gives some details of costs of aerial photography in Surinam.

4424. Ivoninskiĭ, A. F., Čilingarjan, T. H., and Popov, V. A. Àèrotaksacija—novaja tehnika lesoustroĭstva. **[Aerial survey—a new technique in forest management.]** *Lesn. Hoz.* 5 (9), 1952 (43–4). [Russ.]

A note on the extended rôle of aerial survey under the new U.S.S.R. management instruction, especially in the Siberian and Far East forests where staff and labour are scarce. The instruction allows assessments of age, composition, density and site conditions from low-flying (200–400 m.) aircraft, in conjunction with carefully studied aerial photos on which contour lines have been sketched.

4425. Temnoev, N. I., and Širokovskaja, E. A. Proverka dannyh aèrovizualjnogo geobotaničeskogo obsledovanija metodom sličenija. **[Checking the results of visual aerial reconnaissance in geobotanical surveys by comparison with ground control plots.]** *Bot. Ž.* 40 (1), 1955 (91–6). 2 refs. [Russ.]

With reference to trials in the far northern forests of the U.S.S.R. in surveys of lichen cover for reindeer pasturage.

6. FOREST MANAGEMENT. BUSINESS ECONOMICS OF FORESTRY. ADMINISTRATION AND ORGANIZATION OF FOREST ENTERPRISES

4426. Bruns, P. E. **Applied forest management.** Published by the author, 119 Mount Avenue, Missoula, Montana. 1955. pp. xvii + 383 + 1 photo. 16 pp. of refs. Price $5·00.

An elementary textbook, with chapters on: The scope of forest management; extensive forestry; the economics of logging and forestry; forest inventories; forest roads; the management of young stands; forest regulation; the management plan; business records; land use; intensive forestry.

61. FOREST MANAGEMENT: GENERAL, THEORY AND PRINCIPLES

See also Nos. 3945, 4429–30.

4427. ALEXANDER, J. A. **Management of White Stringybark forests (*Eucalyptus eugenioides*) for pulpwood production.** *Aust. For.* 18 (2), 1954 (74–85).

Gives an account of the management studies, silvicultural treatments, and regeneration trials being carried out by Australian Paper Manufacturers Ltd. in their foothill forests in the East Gippsland region. These are to be managed intensively on short rotations for pulpwood production, since for kraft pulping it has been found that the quality of Eucalypt wood decreases with age.

62. WORKING PLANS. ANNUAL OR PERIODIC YIELD. YIELD REGULATION

See also Nos. 4817, 4845–6.

4428. POLYCARPOU, A. **Classification of forests into crop types and the preparation and interpretation of stock maps in Cyprus.** *Tech. Pamphl. For. Dep. Cyprus* No. 17, 1954. pp. 11 + 2 dgms. + 2 maps.

The classification takes into consideration (1) composition (conifers, hardwoods, and various mixtures), (2) vertical structure (saplings, poles, middle-aged stands, mature stands, irregular groups), and (3) horizontal structure (% of crown cover). The crop types classified in this way, and the appropriate map symbols, are set out in tabular form.

4429. CAMPBELL, R. A. **Tree grades and economic maturity for some Appalachian hardwoods.** *Sta. Pap. Stheast. For. Exp. Sta.* No. 53, 1955. pp. 22. 12 refs.

4430. GROSS, L. S. **Forest growing stock.** *J. For.* 53 (6), 1955 (403–8). 5 refs.

Discusses, with examples from Douglas Fir and Southern Pine/ hardwood forest, the importance of growing-stock data, the desirability of the cubic foot unit where pulpwood and timber are produced, the use of yield tables to determine normal stocking, and the fixing of goals for its attainment, the importance of working to an attainable goal with a normal distribution of age classes weighted for the various productivities of different sites, and prescriptions in working plans for the gradual attainment of these conditions.

4431. BOOTH, G. A. **Working plan for the *Acacia nilotica* forest reserves, Gezira Circle.** *Mem. For. Div., Sudan.* No. 6, 1954. pp. 108. Price *P.T.*40 [8*s.*]

64. FORESTRY AS A BUSINESS: GENERAL

See also Nos. 4591, 4839.

4432. HOHL, H. Betriebswirtschaftliche Betrachtung der Forstwirtschaft. **[Forestry considered from the point of view of business economics.]** Verlag Paul Haupt, Berne. 1952. pp. 168 + folding tbl. 80 refs. [G.] (*Unternehmung und Betrieb: Beiträge zur Betriebswirtschaftslehre* No. 39.) Price *Swiss Fr.* 13.

Pt. I. (pp. 9–18) outlines the principles of modern business economics; Pt. II (pp. 18–164) examines in detail the application of the theory of business economics to forestry. The references are almost all German and Swiss.

4433. BINNS, SIR B. O. **Plantations and other centrally operated estates.** *FAO agric. Stud.* No. 28, 1955. pp. 41. 5 refs.

'Plantation' is here used in the sense of a large, centrally operated estate, usually monocultural and worked by hired labour. The question is dealt with under the heads of classification (by landholders, land use or primary purpose), tenure, individual and family estates, estates operated by stock companies, state enterprises, 'plantations', and the place of large estates in a modern agricultural economy.

65. SPECIAL BUSINESS PROBLEMS OF TIMBER-GROWING. CALCULATION OF COSTS AND PROFITABILITY. VALUATION

See Nos. 3930, 3938, 4079, 4081, 4090, 4201, 4734, 4736.

66. COSTING OF LOGGING OPERATIONS

See also Nos. 3938, 4123, 4143.

4434. SMITH, R. F. **The reclamation of derelict woodland.** *Agriculture* (*J. Minist. Agric., Lond.*) 61 (10), 1955 (482–4). O.R.E.

Methods and costs of clearing for agriculture a block of 30 acres of coppice and scrub at Red Wood, Royston, Herts, where a stand of hardwoods had been felled early in the second World War. It is estimated that, at a cost of £40/acre (ignoring income tax concessions but allowing for grants), the capital outlay is likely to be recovered out of profits within 5 or 6 years.

67. ASSESSMENT OF FINANCIAL RESULTS; BOOK-KEEPING AND ACCOUNTANCY; BUSINESS STATISTICS; SHORT-TERM PLANNING AND FINANCING

4435. BARRACLOUGH, S. L., and GOULD, E. M., JR. **Economic analysis of farm forest operating units.** *Bull. Harv. For.* No. 26, 1955. pp. 145. 117 refs.

A detailed study of the budget analysis and forest planning of 9 dairy/woodland farms in New England, with indications of the type of data required for such analysis, and the research needed to provide it where lacking.

68. ADMINISTRATION AND ORGANIZATION OF FOREST ENTERPRISES

681. *National (Federal, State) Forest Services and Administration*

4436. **A history of the Uganda forest department 1930–1950.** *Bull. For. Dep. Uganda* No. 4, 1955. pp. 43. 40 refs.

7. MARKETING. ECONOMICS OF TRANSPORT AND THE WOOD INDUSTRIES

4437. TEILLAC, J. Les bois de la Côte d'Ivoire: leurs conditions d'exploitation et de vente. **[The timbers of the Ivory coast; exploitation and marketing.]** Éditions Maritimes et Coloniales, Paris. 1954. pp. 88. 7 refs. [F.]

Contains sections on the history and geography of the region, the forest and its characteristics, its economic value, different species and their uses, logging conditions and costs and marketing (grading, contracts of sale, production and exports).

71. MARKETING OF FOREST PRODUCTS: GENERAL

4438. **The marketing of woodland produce.** *Journal of the Royal Institution of Chartered Surveyors, London* 34 (5), 1954 (347–60). L.S.

A memorandum of evidence by the Institution sent to the Departmental Committee on the Marketing of Woodland Produce, set up by the Agricultural Ministers in 1954. Points dealt with are: the need for and fundamental principles of a sound forest economy, the status of private forests, production of timber in Great Britain, markets and channels of disposal for woodland products, financial aspects of production and disposal, the future of private forestry and recommendations for the future. Appendices give: (1) an analysis of woodland areas in Great Britain, and (2) government grants and subsidies available for woodlands.

4439. CARROLL, W. M., TROTTER, C. E., and NORTON, N. A. **Marketing forest products in Pennsylvania: a study of marketing practices and pricing processes at the farm level, 1947 through 1951.** *Progr. Rep. Pa. agric. Exp. Sta.* No. 131, 1955. pp. 8.

72. THE QUANTITATIVE ASPECTS OF MARKETING. DEMAND, CONSUMPTION AND SUPPLY

See also Nos. 4817, 4828, 4851.

4440. Le marché des bois tropicaux en Hollande. **[The market for tropical timbers in the Netherlands.]** *Bois For. Trop.* No. 41, 1955 (48–50). [F.]

4441. Le marché des bois tropicaux en Égypte. **[The market for tropical timbers in Egypt.]** *Bois For. Trop.* No. 41, 1955 (45–7). [F.]

4442. **Timber supply in Papua—New Guinea.** *Aust. Timb. J.* 21 (2), 1955 (144).

Gives the production, imports and exports (to Australia and other countries) for the years 1948–49—1952–53 with notes on recent development in the logging industry.

73. PRICES

See Nos. 4736, 4828.

79. ECONOMICS OF THE WOOD INDUSTRIES

See also Nos. 4645, 4828.

4443. **World pulp and paper resources and prospects.** FAO, New York. 1954. pp. vii + 102. Price $1·25 (6*s.* 3*d.*).

A survey prepared by FAO, in co-operation with UNESCO, ECE, and ECLA, and containing the following chapters: (1) Introduction; (2) The economic background; (3) Survey of potential demand; (4) World pulp and paper production, 1913 to 1950–52; (5) The situation in the regions (Europe, N. America, U.S.S.R., Latin America, Far East, Near and Middle East, Africa, Oceania); (6) The prospects for future developments in the deficit regions; (7) Conclusions; with appendixes on forest resources, technical advances, inter-continental trade, newsprint problems, and the FAO Pulp and Paper Missions. There are 79 tables.

4444. **Financing pulp and paper development in Latin America.** *Unasylva* 9 (1), 1955 (20–9). 6 refs.

A paper prepared by FAO staff for discussion by the Latin American Meeting of Experts on the Pulp and Paper Industry, at Buenos Aires in Nov. 1954.

4445. WESTGATE, R. **Tasman newsprint plant. New Zealand's biggest industrial enterprise.** *Pulp Paper Mag. Can.* 52 (12), 1954 (104–7).

Notes on finance, acreages of plantations by species, logging contractors, cost of government works on port, railway, roads, electric transmission etc., use of natural steam for kilning timber, paper mill management contractors, markets, price policies and main pulp and paper mill equipment in detail.

4446. GOODFELLOW, G. A. M. **Fire insurance for sawmills. Hazards and their effects on rates—Reducing the risk and concessions—Consequential loss factor.** *Timb. Tr. J.* 213 (4103), 1955 (104).

8. FOREST PRODUCTS AND THEIR UTILIZATION

See also No. 3716.

4447. **Report of the Third Conference on Wood Technology, May 1954.** *FAO For. Developm. Pap.* No. 7, 1955. pp. 204. 27 refs. [E. F. Span.] Price $2·00 or 10*s.*

The report of the proceedings is given in English, French and Spanish. The bulk of it (pp. 72–204) consists of a series of Annexes, in English only: (1) Recommended methods of test for evaluating the properties of solid timber; (2) Recommended methods of test for evaluating the properties of veneer, plywood, and other glued veneer constructions; (3) Progress report on development of test methods for evaluating additional properties of fibreboards; (4) Resistance of wallboards to pull-through of nail-heads; (5) Fibreboard puncture test; (6) Brief descriptions of some fire-test methods used for wood and wood-base materials.

81. WOOD AND BARK: STRUCTURE AND PROPERTIES

4448. KNUCHEL, H. Das Holz: Entstehung und Bau, physikalische und gewerbliche Eigenschaften,

Verwendung. Holzarten-Lexicon. [**Wood: its formation and structure, physical and technical properties, and uses. Lexicon of wood species.**] Verlag H. R. Sauerländer & Co., Aarau and Frankfurt am Main. 1954. pp. 472. Many refs. [G.] Price [£2. 11*s*. 6*d*.]

In 3 parts: (1) Wood: structure, a key to identification, physical and mechanical properties, defects. (2) Conversion, improvement and uses of wood: building timber, improvement of natural qualities, wood as raw material for chemical industries. (3) Species: mainly a description of the most important commercial species by continents, giving, for each, synonyms, trade and vernacular names, distribution, growth characteristics, and properties and uses of the wood. Each section has an extensive bibliography. There are many illustrations, and subject and species indexes.

4449. **Partial list of publications for furniture manufacturers, woodworkers and teachers of wood shop practice**. *Rep. U.S. For. Prod. Lab., Madison* No. 1775 [*A*], 1955. pp. 21. P.R.

U.S.A. publications, since 1926. Includes publications on: growth, structure and identification of wood; moisture content, physical properties, air and kiln drying; grading, manufacturing and utilization; strength and related properties of joints and fastenings; glues and gluing, veneer and plywood; and box and crate construction.

4450. **List of publications on the growth, structure, and identification of wood.** *Rep. U.S. For. Prod. Lab., Madison* No. 177, 1955. pp. 30. P.R.

Includes publications giving general information and the results of research by the U.S. Forest Service on the structure and identification of wood and kindred subjects. The earliest items cited date back to 1914.

810. *General Information on Woods*

See also Nos. 3842, 3846, 3851, 3857–9, 3961, 3966–7, 4750.

4451. HART, G. **Timbers of south east Asia.** Timber Development Association, London. 1955. pp. 91. 13 refs.

Gives, for some 40 timbers arranged alphabetically under the [British] standard name, the botanical and native names and data on distribution, the tree, and the timber, covering its appearance, seasoning and strength properties, durability, working qualities, uses and availability.

4452. CRAWFORD, I. A. **Turnery timbers of N.S.W.** *Tech. Notes For. Comm.* (*Div. Wood Technol.*) *N.S.W.* 8 (2), 1954 (12–9).

Gives the standard and botanical names, colour, weight, susceptibility of sapwood to insects, distribution, and remarks on figure, grain, texture, stability and working qualities, of 19 soft, 16 moderately hard and 17 hard turning woods indigenous in N.S.W.

4453. LAMB, G. N. **Foreign woods.** *Wood, Chicago* 58 (3), 1953 (46, 75); 59 (8; 11), 1954 (46; 49); 60 (3), 1955 (52).

(*a*) Porcupine wood (*Centrolobium* spp.), Sapucaia or Monkey Pot (*Lecythis* spp.), and Logwood (*Haematoxylon campechianum*).

(*b*) Kurokai (*Protium decandrum*) and Sapucaia (*Lecythis paraensis*).

(*c*) Acapu (*Vouacapoua americana*) and Blue Mahoe (*Hibiscus tiliaceus*).

(*d*) Mastic (*Sideroxylon* spp.) and Hurawood (*Hura crepitans*).

4454. **Specimen woods Nos. 232–3.** *Suppls.* to *Wood* 20 (4), 1955. Each pp. 2.

Bitterwood (*Vatairea lundellii*); Sen (*Kalopanax* spp.).

4455. ARKWRIGHT, P. **Know your timbers. (Some imported woods and their characteristics.) Nos. 1–17.** *Woodwkg. Ind.* 11 (1–12), 1954 (53; 117; 181; 240; 302; 364; 421; 474; 537; 597; 655; 752); 12 (1–5), 1955 (50; 110; 177; 243; 309). P.R.

Summary of the properties and uses of: (1) Opepe [*Sarcocephalus diderrichii*]; (2) Idigbo [*Terminalia ivorensis*]; (3) Rauli [*Nothofagus procera*]; (4) Kokrodua [*Afrormosia* sp.]; (5) White Chuglan [*Terminalia bialata*]; (6) Mansonia [*M. altissima*]; (7) Red Meranti [*Shorea* spp.]; (8) Yang [*Dipterocarpus* spp.]; (9) Berlinia [*B. auriculata, B. heudelotiana*]; (10) Nyankom [*Tarrietia utilis*]; (11) Ramin [*Gonystylus* spp.]; (12) Mandio [*Qualea* spp.]; (13) Odoko [*Scottellia coriacea*]; (14) Parana Pine [*Araucaria angustifolia*]; (15) Abura [*Mitragyna stipulosa, M. ciliata*]; (16) Haldu [*Adina cordifolia*]; (17) Celtis [*C. soyauxii*].

4456. La page des bois tropicaux. [**Tropical woods.**] *Rev. Bois Appl.* 10 (4–6), 1955 (37; 34; 33). [F.]

Tchitola (*Pterygopodium* [*Oxystigma*] *oxyphyllum*); Framiré (*Terminalia ivorensis*); Ilomba (*Pycnanthus kombo*).

4457. NARAYANAMURTI, D. **Composite wood timbers: *Cryptomeria japonica*—Suji.** *Comp. Wood* 2 (1), 1955 (15–8). 9 refs. P.R.

4458. BETTS, H. S. **Incense Cedar (*Libocedrus decurrens*).** *Amer. Woods U.S. For. Serv.* Revised 1955. pp. 4. 8 refs.

4459. FONTES, L. FELIPPE. *Pinus caribaea*, Morelet, *Pinus palustris*, Miller—suas madeiras, produtos químicos, aplicações, dados estatísticos. [***P. caribaea* and *P. palustris*—timbers, chemical products, uses, statistics.**] *Ediç. Prop. Serv. flor. Est. S. Paulo* No. 46, 1954. pp. 15. 8 refs. [Port.]

4460. **Properties of thinnings of home-grown Corsican Pine (*Pinus nigra* var. *calabrica*). Progress report 1—Consignment No. 800.** Forest Products Research Laboratory, Princes Risborough. 1955. pp. 12 + 4 photos.

Material from 65-year trees from the Forest of Bere, Hampshire, seasoned and worked well and would produce a good joinery timber if pruned early. Bad whorls of knots caused heavy degrade and there was a tendency to breakage across the whorls in strength tests.

4461. SPEE, H. J. GRAF VON. Wuchs und Holzeigenschaften des Riesenlebensbaumes (*Thuja*

plicata Lamb.) auf deutschen Anbauflächen. [**Growth and wood properties of *T. plicata* in plantations in Germany.**] Dissertation, Forstliche Fakultät der Univ. Göttingen, Hann. Münden. 1952. pp. 65 + 16 gphs. + 4 dgms. + 10 photos. 25 refs. [G.]

Covers growth and form, characters of the timber in log form, wood structure, strength properties and durability, mainly on the basis of material from 11 stands (pure and mixed) on various sites in different parts of W. Germany.

4462. GUINIER, P. Le châtaignier. [***Castanea sativa.***] *Rev. Bois Appl.* 10 (4), 1955 (10–6). 1 ref. [F.]

Describes the conditions in which *C. sativa* can thrive, the structure and properties of its wood, and its uses.

4463. GUINIER, P. Le robinier ou faux-acacia. [***Robinia pseudoacacia.***] *Rev. Bois Appl.* 10 (6), 1955 (3–5). [F.]

Describes the tree and wood of *R. pseudoacacia.*

4464. KUBINSKÝ, E. Priemyselná spracovatel'nost' topol'ov a z toho výplývajúce poznatky pre ich pestovanie. [**Industrial utilization of Poplars and its effect on silvicultural practice.**] *Les, Bratislava* 2 (1/2; 3), 1955 (24–8; 86–93). [Slovak.]

Presents tabulated results of tests and measurements (physical and mechanical properties, use for rotary veneer, matches, pulp and paper) made in 1951–53 on 57 stems of the following species: × *Populus robusta*, *P. canescens*, *P. alba*, *P. monilifera*, × *P. serotina*, *P. nigra*, × *P. marilandica*, × *P. regenerata*, and *Salix alba* × *fragilis*. The best strength properties were found in × *P. robusta*; the most suitable for manufacture of veneer were *P. monilifera*, × *P. robusta* and × *P. marilandica*. All the species tested are of considerable economic value, and their propagation is recommended.

4465. Hazotokana. [***Brachylaena* spp.**] *Bois For. Trop.* No. 40, 1955 (13–6). [F.]

Deals particularly with *B. ramiflora* and *B. merana*, but also gives the distribution of other species, all of them endemic in Madagascar and the Comoro Is.

4466. TAMESIS, F., and AGUILAR, L. **The 'Philippine Mahogany' and other dipterocarp woods.** *Popular Bulletin, Department of Agriculture and Natural Resources, Manila* No. 44, 1953. pp. 123.

General information on forest stands, harvesting, conversion, and distribution of lumber, and detailed information on *Shorea* (16 spp.), *Pentacme* (2 spp.), *Parashorea plicata*, *Hopea* (7 spp.), *Balanocarpus* (2 spp.), *Dipterocarpus* (11 spp.), *Anisoptera* (4 spp.), and *Vatica* (7 spp.). There are tabular keys, 10 photos, and 35 drawings of leaves, flowers and fruit.

4467. FERNANDO, X. M. **Notes on Ceylon timbers: *Artocarpus integra* Merr.** *Ceylon For.* (*n.s.*) 2 (1), 1955 (45–6). 8 refs.

Notes on anatomy, mechanical properties, seasoning, durability and working qualities.

4468. **Sydney Blue Gum.** *Tech. Notes For. Comm.* (*Div. Wood Technol.*) *N.S.W.* 8 (1), 1954 (3–6).

Gives the N.S.W. range, morphology, wood anatomy, utilization, durability, seasoning and physical and mechanical properties of *Eucalyptus saligna.*

4469. **Ribbon Gum, *Eucalyptus viminalis.*** *Tech. Notes For. Comm.* (*Div. Wood Technol.*) *N.S.W.* 8 (2), 1954 (3–6).

Gives the distribution, morphology, macro- and microscopic characters of the timber, utilization, durability, seasoning and physical and mechanical properties. The standard name is Manna Gum.

4470. STEPHENS, M. **The timber of *Xanthophyllum verrucosum* Chodat (Minyak Berok).** *Malay. Forester* 18 (2), 1955 (89–90). 2 refs.

4471. Makoré. [***Mimusops heckelii.***] *Bois For. Trop.* No. 41, 1955 (19–22). [F.]

811. *Structure, Identification*

See also Nos. 3851, 4510, 4696.

4472. PERELYGIN, L. M. Stroenie drevesiny. [**The structure of wood.**] Institut Lesa, Akademija Nauk S.S.S.R., Moscow. 1954. pp. 199. 86 refs. [Russ.] Price *Roubles* 8·75.

An illustrated elementary manual with two major sections: (1) Macroscopic structure of wood and bark; (2) Microscopic structure of wood and bark (fundamentals of structure; conifers; deciduous species). A brief final section deals with the structure and properties of Bamboo and of *Haloxylon.* There is frequent discussion throughout the work of the relation of structure to properties.

4473. TARASCHI, F. Microscopia normale e in contrasto di fase per sezioni di legno e materiale fibroso. [**Normal and phase-contrast microscopy for the examination of wood sections and fibrous material.**] *Cellulosa e Carta* 6 (4), 1955 (8–17). 5 refs. [It.f.e.]

Illustrated by 32 photomicrographs of wood of *Pinus ponderosa*, *Abies alba*, *Fagus sylvatica*, *Populus tremula*, *P.* '*canadensis*', *Robinia pseudoacacia*, *Castanea sativa*, Bamboos, and straw and cotton linters. The value of microscopic examination of wood, as well as cellulose, of possible pulpwood species is emphasized.

4474. JACQUIOT, C. Atlas d'anatomie des bois des conifères. [**Anatomical atlas of the wood of conifers.**] Centre Technique du Bois, Paris. 1955. pp. 133 + 64 photos. 23 refs. [F.E.] P.R.

In two volumes, the second containing photomicrographs. Covers 68 species and includes a key to the genera of Ginkgoales and Coniferae, and to the species of *Pinus.*

4475. MENON, P. K. B. **Card sorting key to identification of Malayan timbers.** *Malay. For. Rec.* No. 18, 1954. 48 cards + 24 pp. of notes + needle, in case. Price $5·00.

The key covers only the 48 timber groups that at present constitute the main bulk of the commercial timbers of Malaya.

4476. JOHNSTON, D. R. **Structure drawings to 'Specimen woods' Sheets 46–47.** *Wood* 20 (4; 5), 1955 (132; 191).

(46) Merbau (*Intsia bakeri*), Geronggang (*Cratoxylon arborescens*), Yemeri (*Vochysia hondurensis*), and Puna (*Tetramerista glabra*).

(47) Jelutong (*Dyera costulata*), Kempas (*Koompassia malaccensis*), Japanese Maple (*Acer palmatum*), and Olivillo (*Aextoxicon punctatum*).

4477. SHIMAJI, K. **Anatomical studies on the wood of Japanese *Quercus*. II. On the sub-genus *Cyclobalanopsis* (Kashi group).** *Bull. Tokyo Univ. For.* No. 47, 1954 (125–43). 9 refs. [E.e.jap.]

Continuing the study [see *For. Abstr.* 15 (No. 4012)], the anatomical characters are given for (1) *Q. acuta*, (2) *Q. gilva*, (3) *Q. myrsinaefolia*, (4) *Q. paucidentata*, (5) *Q. stenophylla*, (6) *Q. glauca* and (7) *Q. hondai*. *Cyclobalanopsis* and *Quercus* are retained as sub-genus and genus respectively. The group is homogeneous, all species being evergreen, having pores radially arranged, and the vessels, both spring and summer, thick-walled with rounded ends. In these characters they resemble section *Ilex* of *Lepidobalanus*. Nos. (1) and (7) have aggregate or semi-compound broad rays, the rest, semi-compound. Differences in ray type among them and *Ilex* section of sub-genus *Lepidobalanus* are not essential, and the coincidence of the other characters mentioned brings sections *Ilex* and *Suber* into closer relation with *Cyclobalanopsis* than with *Lepidobalanus*. No. (7) is peculiar in the thinness of its tracheid walls. A timber key is given and 28 photomicrographs illustrate the transverse and tangential sections of the 7 species and the ontogeny of the broad ray in No. (2).

4478. YOUNGS, R. L. **The xylem anatomy of *Orthopterygium* (Julianaceae).** *Trop. Woods* No. 101, 1955 (29–43 + 8 photos). 34 refs.

The form and size of the xylem elements in *O. huaucui* do not justify the separation of the family into 2 genera. The woods of the family are like those of Anacardiaceae and differ in several important features from Juglandaceae.

4479. RANGASWAMI, K., and RAJAGOPALAN, V. R. **Observations on the vascular anatomy of the stem of *Barringtonia acutangula* Gaertn.** *J. Indian bot. Soc.* 33 (3), 1954 (259–62). 4 refs. O.B.D.

811.1. Anatomical Elements and Tissues

See also Nos. 3776, 3905, 4501–2, 4509, 4520–1, 4538, 4545.

4480. BALASHOV, V., and PRESTON, R. D. **Fine structure of cellulose and other microfibrillar substance.** *Nature, Lond.* 176 (4471), 1955 (64–5). 31 refs. [Botany Dept., University of Leeds.]

Electron-diffraction study of *Valonia* cellulose and other substances seems to show that there may be some principle of structure conferring special stability in fibres ca. 200 Å. thick. The microfibril of cellulose might then be not a biological, but a thermodynamic, unit.

4481. DOLMETSCH, H. Über den Aufbau der Cellulose in den Zellwänden der pflanzlichen Faserzellen. **[Structure of cellulose in the wall of plant fibre cells.]** *Holz Roh- u. Werkstoff* 12 (11), 1954 (419–26). 19 refs. [G.g.] P.R.

The subdivision of the secondary wall of fibre cells into individual, parallel fibrils of standard size is explained, in analogy to similar growth processes (fungal growth, ice efflorescence), as the unavoidable result of narrowly defined growth conditions. The constancy of the acute-angle gradient that these fibrils form with the fibre axis is assumed to relate to the existence, on the surface of the protoplasm, of zones of 'germination' or secretion, which run at right angles to the axis.

4482. ASUNMAA, S. **Morphology of middle lamella of Swedish Spruce (*Picea excelsa*).** *Svensk PappTidn.* 58 (8), 1955 (308–10). 10 refs. [E.e.g.sw.] P.R.

Four samples of Spruce were examined by electron and ultra-violet microscope: *A* and *B* attacked by *Coniophora cerebella* and *Polyporus* sp. respectively; *C*, sound 12-year-old Spruce; and *D*, young shoots. Results, illustrated in photomicrographs, show the middle lamella clearly defined in all specimens. A more detailed analysis of the results will be given in a later issue of the journal.

4483. NEČESANÝ, V. Elektronenmikroskopische Untersuchungen der Tyllen und der Kernstoffe der Rotbuche, *Fagus sylvatica* L. **[Electron-microscope investigations of tyloses and heartwood substances (gums) in Beech.]** *Bot. Tidskr.* 52 (1), 1955 (48–55). 9 refs. [G.g.] O.B.D.

4484. KAEISER, M., and STEWART, K. D. **Fiber size in *Populus deltoides* Marsh. in relation to lean of trunk and position in trunk.** *Bull. Torrey bot. Cl.* 82 (1), 1955 (57–61). 7 refs. O.B.D.

Studies were made on 8 samples of wood from a Cottonwood with a lean of 12°. It was established that (1) fibre lengths are greater in outer than in inner growth rings at the same stem level, (2) length of fibre in outer rings was greater at higher stem levels, and (3) no relationship existed between lean of stem and fibre length.

4485. KAEISER, M. **Frequency and distribution of gelatinous fibres in Eastern Cottonwood [*Populus deltoides*].** *Amer. J. Bot.* 42 (3), 1955 (331–4). O.B.D.

Four vigorously growing trees showing a lean from the vertical were selected for study. At breast height in all 4, the comparative number of gelatinous fibres was greater in the upper area of lean, with the lower area having the same or less than the lateral areas. Readings at an intermediate height for tree 2, which had a decided twist in the trunk at that height, showed a slightly larger value in the lateral than in the upper area. Trees 3 and 4 showed greater values in the upper area, with lesser values in the lateral and lower areas. At mid-height and at the top of merchantable timber height, however, a considerable shift in comparative numbers was noted, with the lateral, and finally the lower areas (as related to the areas so designated at breast height) having the greater comparative numbers of gelatinous fibres. It is possible that the readjustments necessitated by the initial lean may account for the differences in readings at the higher levels sampled. *From author's summary.*

4486. CHALK, L. **Ray volumes in hardwoods.** *Trop. Woods* No. 101, 1955 (1–10). 5 refs.

The proportion of ray tissue in 240 mainly tropical species ranged from 5·3 to 59·3%; 72% of the species had between 9 and 24%, the highest frequency lying about 16%. No essential difference was seen between tropical and temperate hardwoods. A positive correlation exists between the % of ray tissue and the maximum width of ray, measured in number of cells; this latter is negatively correlated with number of rays. Some families, e.g. Leguminosae, Moraceae, and Rutaceae, are characterized by low %s of ray tissue. The % is probably important in differential shrinkage.

811.2. Special Features and Abnormal Structure

See also Nos. 4485, 4731.

4487. KOBAYASHI, Y. **[Anatomical studies on the resin cysts of Japanese *Abies* wood.]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 77, 1955 (153–64). 10 refs. [Jap.jap.e.]

Describes, with photomicrographs, tangentially arranged resin cysts, believed to be of traumatic origin (here reported for the first time from Japan) in *Abies*. The occurrence is important as it may lead to confusion in the macroscopic identification of *Picea*.

4488. DEUTSCHMANN, F. Anatomische Untersuchungen über die Harzgänge einiger Dipterocarpaceae. **[Anatomical studies of the resin canals of some Dipterocarpaceae.]** *Ber. dtsch. bot. Ges.* 67 (10), 1954 (381–4 + 1 plate). 8 refs. [G.] O.B.D.

Microscopic studies were made of 76 species of 14 genera, development being followed in 8 species. The results show that the resin canals do not originate in the pith as generally supposed, but, with the exception of *Dryobalanops*, in the procambium.

811.4. Growth Rings. Early and Late Wood

See Nos. 4403–6.

811.5. Sapwood and Heartwood

See also Nos. 3771, 4483, 4730.

4489. WELLWOOD, R. W. **Sapwood-heartwood relationships in second-growth Douglas Fir.** *For. Prod. J.* 5 (2), 1955 (108–11). 10 refs. (*Res. Pap. Fac. For. Univ. B.C.* No. 9.)

Sample discs were examined from 54 trees, 59–78 years old, in the crown classes dominant, codominant and intermediate, and of 3 crown qualities, from the base, ⅓ total height, or top of merchantable stem, on sites with indexes ranging from 93 to 160. Results show that site has no marked effect on the width of sapwood, but in each of the arbitrary site groupings, average and good dominants have a wider sapwood band than the other crown classes. Crown quality has no consistent effect within sites but sapwood width is significantly greater on good than on average sites for the top and middle sections of trees with good crowns. Sapwood width is greatest at the base and least at the middle part of the tree. [Cf. *For. Abstr.* 16 (No. 3358).]

811.6. Texture, Grain, Figure

See also No. 4031.

4490. PILLOW, M. Y. **Detection of figured wood in standing trees.** *Rep. U.S. For. Prod. Lab., Madison* No. 2034, 1955. pp. 3 + 5 photos. P.R.

Investigations at Madison have shown that both the curly grain (e.g. in Black Walnut) and the bird's-eye figure (in Sugar Maple) can be detected from the appearance of the rough outer bark.

811.7. Phloem. Bark

See also Nos. 4108, 4490.

4491. CHANG, Y.-P. **Anatomy of common North American pulpwood barks.** *Tappi Monograph, New York* No. 14, 1954. pp. [4] + 249. 121 refs. P.R.

Eight coniferous and 12 broadleaved species were studied, the material being taken at b.h. from at least 3 stems for each species. The description for each species includes general features and anatomical structure (brief account of young bark, a full description of mature bark). Features of diagnostic value in the structure of coniferous and dicotyledonous bark are separately tabulated. The effect of structure on the thickness of bark is discussed. [Cf. *For. Abstr.* 16 (No. 3360).]

4492. CHATTAWAY, M. M. **The anatomy of bark. II. Oil glands in *Eucalyptus* species.** *Repr.* from *Aust. J. Bot.* 3 (1), 1955 (21–7 + 2 plates).

[Cf. *For. Abstr.* 15 (No. 1741).] Spherical oil glands of lysigenous origin have been observed as a conspicuous feature of the phloem of 41 *Eucalyptus* species. Details of their development from rays of phloem parenchyma are described and their contents and functions discussed. *From author's summary.*

4493. CHATTAWAY, M. M. **The anatomy of bark. III. Enlarged fibres in the Bloodwoods (*Eucalyptus* spp.).** *Repr.* from *Aust. J. Bot.* 3 (1), 1955 (28–38 + 4 plates). 4 refs.

Immensely enlarged fibres which are characteristic of certain Bloodwoods separate them clearly from other species with which they are usually associated in the systematic classification of the genus *Eucalyptus*. Separation of the two types of Bloodwood herein described agrees closely with a regrouping recently suggested on morphological characteristics [cf. *For. Abstr.* 15 (No. 1143)]. Other Eucalypts with large bark fibres are described briefly and their relationship considered. *Author's summary.*

4494. CHATTAWAY, M. M. **The anatomy of bark. IV. Radially elongated cells in the phelloderm of species of *Eucalyptus*.** *Repr.* from *Aust. J. Bot.* 3 (1), 1955 (39–47). 8 refs.

The occurrence of a palisade of radially elongated cells, sometimes heavily sclerosed, in the phelloderm of certain *Eucalyptus* species is described. These cells have been observed in 71 of 272 species examined. They vary greatly in degree of development, both between different species and, in some cases, within the same species. The extreme variations are discussed with special reference to the occurrence of interspecific hybridization within the genus. *From author's summary.*

812. *Physical and Mechanical Properties*

See also Nos. 3851, 3964, 4447, 4510.

4495. DeZeeuw, C. H., and Skaar, C. **Equipment for conditioning and testing wood in small plants.** *For. Prod. J.* 5 (1), 1955 (21*A*–25*A*).

Discusses the equipment needed and different types available.

812.1. Optical, Acoustic, Frictional, Thermal and Electrical Properties

4496. Nambiyar, V. P. N. **Action of fossil wood on photographic plates.** *Curr. Sci.* 24 (1), 1955 (13–4). 4 refs. A.P.B.

Investigations of the Russel effect in Indian woods [cf. *For. Abstr.* 14 (No. 1502)] have been extended to fossil species. An image resembling a Russel image was obtained, but fossil wood appears to differ from ordinary wood in that it does not exhibit a marked increase in activity after irradiation by sunlight.

4497. Sindo, K. **The effect of temperature on the dielectric properties of wood.** *Busseiron Kenkyu, Osaka* No. 79, 1954 (57–63). [Jap.?] From *abstr.* in *Chem. Abstr.* 49 (8), 1955 (5833). L.S.

The dielectric constant and loss of a wood plate of *Fraxinus spaethiana* were measured between 20 and 50° C. by the resonance method at frequencies of 10^5 to 10^7 cycles/sec. with maximum loss depending on temperature but not on frequency. The sample was dried for 2–3 hours at 100° C. and then over $CaCl_2$ for a month. The results were analysed in the light of a modified Debye theory for a polar liquid, by assuming that the dispersion was due to the sorbed water molecules; this did not prove fully satisfactory.

812.2. Behaviour with Liquids and Gases. Moisture Relations etc.

See also Nos. 4486, 4509, 4539, 4603–4, 4692, 4701, 4721–3.

4498. Kelsey, K. E., and Clarke, L. N. **Effect of temperature and initial moisture content on the heat of wetting of wood.** *Nature, Lond.* 176 (4471), 1955 (83–4). 6 refs. [Division of Forest Products, C.S.I.R.O., Melbourne.]

The authors determined the heats of immersional wetting of wood samples (*Araucaria klinkii*) having initial moisture contents ranging from 0 to 0·24 g./g., the tests being made at 3 temperatures. The results showed that the effect of temperature on the heat of sorption is adequate to account for the departure of specific-heat/moisture-content relation for cellulosic materials from that for simple mixtures. Since the effect may be regarded as being significant only at m.c.'s $> 0{\cdot}12$ g./g., it is suggested that the energy of the binding of the most strongly held water is relatively unaffected by temperature.

4499. Sahnovskiĭ, L. V., and Krasnovskiĭ, N. V. **[Apparatus for rapid determination of wood moisture.]** *Derev. lesohim. Prom.* 2 (7), 1953 (6–9). [Russ.] From *abstr.* in *Holzforschung, Berlin* 9 (3), 1955 (93). [G.] P.R.

Describes a resistance-type moisture meter for the range of 8–30% moisture content in converted wood.

4500. Engelmann, A. Holzfeuchtigkeitsmessung in der Parkettfabrikation. **[Measurement of wood moisture content in the parquet industry.]** *Holz-Zbl.* 81 (63), 1955 (775). [G.]

Up to 26%, the moisture content can be safely determined by an electrical (capacity) measuring instrument; above this value it is necessary to use a combination of electrical measurements with oven-drying, because only the latter gives reliable results.

4501. Barclay, R. M. **The effect of the middle lamella and anatomical structure on the tangential shrinkage of hardwoods.** *J. Oxf. Univ. For. Soc.* (*Ser. 4*) No. 3, 1955 (5–8). 4 refs.

The experiment provides further proof of the feasibility of using thin sections for studying shrinkage and shows that: (1) Shrinkage of thin sections of 11 hardwoods showed no relation between the number of radial middle lamellae and the degree of tangential shrinkage. (2) A significant positive correlation was observed between tangential shrinkage and the % of vessel tissue. (3) Some indication was observed of a negative correlation between tangential shrinkage and proportions of ray tissue. *From author's summary.*

4502. McIntosh, D. C. **Effect of rays on radial shrinkage of Beech.** *For. Prod. J.* 5 (1), 1955 (67–71). 13 refs.

Radial shrinkage of thin transverse sections (t.s.) of *Fagus grandifolia* without broad rays was 6·73% compared with 2·32% for isolated broad rays from such sections. Photographs of t.s. containing a broad ray show the distortion caused by the greater shrinkage in the adjacent wood than in the ray. It was impossible to separate the fine rays to examine their shrinkage in isolation but the distortion (illustrated) in sections with a fine ray on one radial edge and vertical cells on the other showed that the fine rays shrink less radially than the surrounding cells. From measurements on tangential and cross sections it is estimated that the volume of wood of Beech occupied by ray tissue (broad and fine rays) is about 21%. Tabulated data show that the radial shrinkage of t.s. decreases as the ray tissue % increases. A curve from these data extrapolated to zero ray volume indicates a theoretical radial shrinkage value of 11·7% for t.s. without ray tissue. It is, however, emphasized that this extrapolation is hazardous because of the steep slope of the curve as it approaches a ray volume of 16% (the estimated volume of fine ray tissue in the wood free of broad rays). Further research on the effect of rays on shrinkage and wood strength will be published shortly. [Cf. *For. Abstr.* 15 (No. 4045).]

4503. Paranyi, N. I., and Rabinovitch, W. **Determination of penetration rate of liquid media into wood using a quartz spiral balance. Part 1—Water and an air-dry Spruce chip.** *Pulp Paper Mag. Can.* 56 (3), 1955 (163–70). 10 refs.

Describes a method and apparatus making possible a direct and continuous weighing of a chip

during penetration by a liquid under various temperatures and pressures, and examines the nature of the initial rapid mass penetration and the slow secondary stage and the effects of temperature, pressure, and pressure fluctuations on these rates.

4504. Kolјo, B. Über die Mechanik der Flüssigkeitsbewegung bei der Holzimprägnierung. **[The mechanics of the movements of liquids during wood impregnation.]** *Medd. svenska TräforsknInst.* (*Trätekn. Avd.*) No. 25*B*, 1951. pp. 53 + 18 gphs. 37 refs. [G.g.] P.R.

Describes research on the factors affecting the movement of acetone, methanol, *n*-propyl and *n*-butyl alcohol, water, and glycol in Pine and Birch wood.

4505. McNabb, A., and Taylor, W. B. **A note on some theory relating to the diffusion of chemicals in green timber.** *N.Z. J. Sci. Technol.* 36*B* (5), 1955 (533-6). 2 refs. P.R.

When an aqueous chemical solution is applied to the surface of green timber, the chemical diffuses into the wood. Some relationships between the concentration of the solution at a given depth from the surface and the diffusion time have been published for configurations where the diffusion occurs in directions perpendicular to plane faces. A correction is made to a wrongly cited result in one such case and the corresponding theory for the radial diffusion into timber of circular cross-section is given. *Authors' summary.* [Cf. *For. Abstr.* 15 (No. 4047).]

812.3. Density. Specific Gravity. Buoyancy

See also Nos. 4509, 4730.

4506. Smith, D. M. **Maximum moisture content method for determining specific gravity of small wood samples.** *Rep. U.S. For. Prod. Lab., Madison* No. 2014, 1954. pp. 8. 8 refs. P.R.

Describes a new method for determining the sp. gr. of small wood samples on a green-volume basis, based on the well known relationship between the maximum moisture content and specific gravity.

4507. Bryan, J., and Pearson, F. G. O. **The quality of Sitka Spruce grown in Great Britain.** *Emp. For. Rev.* 34 (2), 1955 (144–9).

An account is given of an investigation into the 'quality', as measured by specific gravity, of Sitka from six plantations in Great Britain. Measurements of sp. gr. were made on successive annual samples, each comprising five growth rings, at various heights, and from a number of trees. Within the tree, sp. gr. tended to be high near the pith, fell to a minimum about 15–20 rings from the pith and then increased steadily to the cambium layer. This pattern occurred in every tree examined, from each site. Strength in compression was generally proportional to sp. gr., with the addition of a superimposed trend of increasing specific strength from pith to cambium, so that the high-density material at the pith did not have correspondingly high strength.

The sp. gr. of the wood accruing at a uniform age of 30 years is directly related to the latitude of growth, the heaviest wood being from trees in southern England and the lightest from trees in northern Scotland. *From authors' summary.*

812.7. Strength Properties

See also Nos. 4403, 4540, 4561–3, 4584, 4586–7, 4605–6, 4613, 4616–23, 4626, 4701, 4761–3.

4508. Venet, J. Essais sur la résistance mécanique du bois de peuplier faits au Laboratoire de Technologie de l'École Nationale des Eaux et Forêts. **[Tests of the mechanical strength of Poplar wood made at the École des Eaux et Forêts, Nancy.]** *Annexe* to [*Pap.*] *8th Sess. int. Poplar Comm., Madrid 1955*, No. *FAO/CIP/75-B*, 1955 (9–12). [F.]

Gives the results of tests on *P. deltoides* ('*carolinensis*'), × *P. regenerata*, and *P. tremula*.

4509. Huršudjan, P. A. Fiziko-mehaničeskie svoïstva drevesiny jasenja ostroplodnogo iz južnoï Armenii. **[Physical and mechanical properties of wood of *Fraxinus oxycarpa* from southern Armenia.]** *Izv. Akad. Nauk armjansk. SSR* (*biol. sel.-hoz. Nauki*) 7 (10), 1954 (49–56). 6 refs. [Russ.arm.] [Botaničeskii Institut Akad. Nauk Armjanskoï SSR.] N.C.L.

F. oxycarpa is much less common in Armenia than *F. excelsior*, but is of interest for its greater drought resistance and ability to thrive on poorer sites. The author presents in tables and graphs the results of tests [number of test pieces not indicated, but standard errors given] on wood from 2 trees (d.b.h. ca. 28 and 36 cm.) growing in mixed, dry-type forest near Varagan. Tables are also included for the wood properties of *F. oxycarpa* compared with those of other Ashes (*F. excelsior*, *F. mandshurica*, *F. pennsylvanica*) and of *Quercus robur* and *Pinus sylvestris* as given in Soviet standards and other literature. In most strength properties the wood shows higher values than that of other Ashes: the exception is its lower shear strength, and it is noted that among Maples the xerophytic *Acer ibericum* has been found by the author to show the same peculiarity when compared with the more moisture-loving *A. campestre* and *A. platanoides*. All strength properties of *F. oxycarpa* were better than those of *Q. robur* and *P. sylvestris*. It is stated that *F. oxycarpa* has thicker libriform-fibre walls (4·0 vs. 3·0μ), and a higher proportion of libriform fibres in the wood, than *F. excelsior*. Data are included on density, shrinkage and swelling, hygroscopicity and water absorption, and Janka hardness. *F. oxycarpa* may be planted in Armenia up to 1650 m. altitude and deserves wide use in the afforestation of dry slopes.

4510. Vihrov, V. E. Stroenie i fiziko-mehaničeskie svoïstva drevesiny duba. **[The structure and physico-mechanical properties of Oak wood.]** Institut Lesa, Akademija Nauk S.S.S.R., Moscow. 1954. pp. 264 + 23 plates. 9 pp. of refs. [Russ.] Price *Roubles* 14·25.

A monograph based chiefly on the author's researches since 1945, already published in part [see *For. Abstr.* 15 (Nos. 651, 713, 3903, 4025)], the aim of which has been to establish correlations between structure and physico-mechanical properties on the

one hand, and growth conditions (forest types and soils) on the other, for wood of *Quercus robur* from 3 groups of forest types in the Tellerman Forest, Voronezh, viz.: (*a*) upland types (especially the *Fraxineto-Quercetum aegopodiosum* and *F.-Q. cariceto-aegopodiosum* on grey forest clay-loams; (*b*) solonets types (*Quercetum salinum*) which suffer from physiological drought in summer; and (*c*) floodplain types (*Quercetum inundatum*) on alluvia with plentiful soil moisture. The material consisted of many samples from different levels in the bole of 5 or 6 trees each, 60–80 years old, from plots in these types, along with material from 8 older trees specially selected to represent the early- and late-flushing forms of Oak.

The chapters are: a review of literature; brief description of the forest and the sample plots; wood structure; physico-mechanical properties; dynamics of increment and the wood properties of the early- and late-flushing forms; variation of properties with radial and longitudinal position in the stem; anatomy and properties of root wood.

Only quantitative differences were found in structure. Sapwood (s.w.) development (no. of s.w. rings) was greatest on (*b*). Living s.w. and heartwood (h.w.) showed little average difference in moisture content (m.c.), but seasonal m.c. variations were greater in h.w. than in s.w., and in August the m.c. of h.w. was higher on (*a*) and (*c*), but lower on (*b*) than that of s.w. Experiments indicate that water moves in times of drought from h.w. to s.w. Annual rings were 2–2·5 times as wide and contained 10–20% more late wood (l.w.) on (*a*) and (*c*). Diameter increment culminated on (*b*) as early as 18–25 years of age. Wood from (*b*) had more vessels and tracheids, and fewer fibres, than that from (*a*) and (*c*). The early wood was more or less identical on all types, but on (*b*) the l.w. was more feebly developed and very porous, though here the early-flushing form showed better growth and a higher late-wood % than the late-flushing, presumably because it makes better use of the plentiful moisture in spring.

Strength values varied considerably with site, being 25–40% (according to the strength property concerned) higher for (*a*), and 10–20% higher for (*c*), than for (*b*). Wood from (*b*) was notably the weakest in impact bending. The strongest wood was found in trees of the late-flushing form, of Kraft classes I–II, in several-storeyed, mixed stands of site quality I–II on type (*a*). On (*a*) and (*c*), wood of the early-flushing form was significantly weaker, but on (*b*) somewhat stronger, than that of the late-flushing. Fewest wood defects are found on type (*a*); on (*c*) frost crack and wood rots (e.g. *Fomes robustus*, *Polyporus dryophilus*, *P. sulphureus*) are more frequent; and on (*b*), which is intermediate as regards frequency of wood rots, non-parasitic abnormalities (forking, crooked growth etc.) are so widespread that the stands produce chiefly firewood, only 10–12% of the trees representing merchantable timber.

The need is now for research to determine, in detail, how far wood quality can be influenced by silvicultural practices; meanwhile the results of the present work afford general guidance.

4511. LEONTJEV, N. L. Uprugie deformacii drevesiny. [**Elastic deformations of wood.**] Goslesbumizdat, Moscow and Leningrad. 1952. pp. 120. 25 refs. [Russ.] Price *Roubles* 5·25. P.R.

Contains the following sections: (1) general concepts; (2) methods of determining coefficients of elastic deformation of wood; (3) relationship between these coefficients and different factors; (4) correlation between the moduli of elasticity of wood; (5) investigation into the coefficients of elastic deformations of wood in different parts of the stem; (6) effect of wood defects on its moduli of elasticity; (7) investigation on deformation of wood under prolonged load, and (8) coefficients of elastic deformation of the woods of the main U.S.S.R. species, giving the moduli of elasticity, their dependence on the physico-mechanical properties of wood, coefficients of the transverse and volume deformations of wood, and a table of the mean value of elastic deformations for 8 species. With only one exception, the literature quoted is Russian.

4512. RADCLIFFE, B. M. **A method for determining the elastic constants of wood by means of electric resistance strain gauges.** *For. Prod. J.* 5 (1), 1955 (77–80). 10 refs.

4513. KOTHARI, D. S., and BHANDARI, R. C. **A note on the elastic constants of fresh twigs.** *Sci. & Cult.* 20 (9), 1955 (452). E.M.B.

Gives for 73 species of Indian hardwood trees and shrubs the values of $q = Y/n$ where $Y =$ Young's modulus and $n =$ the modulus of rigidity. These values are much larger than maxima for isotropic substances. The implication is that, in the structure of stems and twigs, the cross-linking between the fibres plays a significant rôle in determining elastic properties.

4514. GROSSMAN, P. U. A., and KINGSTON, R. S. T. **T.P.16–2. Creep in tension and compression. Progress report No. 1. The influence of stress on creep.** Division of Forest Products, C.S.I.R.O., Melbourne. 1954. pp. 5 + 1 photo + 6 gphs. 3 refs. P.R.

Creep and recovery were observed in wooden tensile specimens of varying cross-section, strains being measured at differently stressed portions of each specimen by means of electrical-resistance strain gauges. The ratios of strain to stress after ca. 2 months were the higher the larger the stress, the increase being due mainly to irrecoverable flow. *Authors' summary.*

4515. GROSSMAN, P. U. A., and KINGSTON, R. S. T. **Project T.P.16. The rheology of wood. Subproject T.P.16–4. The mechanism of creep. Progress report No. 1. Superposition tests.** Division of Forest Products, C.S.I.R.O., Melbourne. 1955. pp. 8 + 2 photos + 2 gphs. 7 refs. P.R.

Special wood specimens have been loaded and unloaded after daily intervals, and creep curves calculated under the assumption of the principle of superposition. The results of tests are graphed and tabulated.

4516. FICKLER, H.-H. Nedböjnings-hastighetens och stödavståndets inverkning vid bestämning av

böjhållfastheten hos fiberplattor, plywood och spånskivor. **[The effect of head speed and span on testing bending strength of fibreboards, plywood and chipboards.]** *Svensk PappTidn.* 58 (4), 1955 (107–12). 7 refs. [Sw.sw.g.e.] P.R.

In an investigation at the Wallboardindustriens Centrallaboratorium, Stockholm, the low head speed of the standard method for testing bending strength of fibreboard, adopted by the F.A.O. conference on mechanical wood technology, 1951 [see *For. Abstr.* 15 (No. 4060)], was found to be too time-consuming for routine analyses and to make it difficult to determine the breaking load. The effect of head speed and span was therefore analysed statistically. The results indicate that the choice of head speed and span within the limits 0·4–2·0 cm./min. and 16–28 × thickness of sample respectively has no significant effect on either standard deviation or coefficient of variance. *From author's summary.*

4517. KOLLMANN, F., and SEKHAR, A. C. **On measurement of toughness in timber: some preliminary investigations.** *Ind. For. Bull.* (*n.s.*) No. 167, 1954. pp. 40. 49 refs.

Introducing toughness as basically a dynamic quality as opposed to static properties, the present methods of testing and correlations between different properties are briefly surveyed. Variation of stiffness with the increasing drops in a Hatt-Turner machine was investigated and a formula derived. Variation of Izod values with variation in specimen size behind a key-hole notch was investigated and the corresponding curves are drawn for three species. Correlation between maximum height of drop in a Hatt-Turner machine and Izod value with different types of notches for wood has been obtained provisionally, and it is considered that a few more results would be helpful for statistical analysis. From the published data of Indian species in *Indian Forest Records*, Vol. 18, Part 10, relationships between toughness as measured in impact and static bending experiments and various other properties, have been graphically obtained. The 32 equations developed have been shown in a table. It is hoped that these results will form a basis for further mathematical analysis and comprehensive treatment of the problem of toughness. *Authors' summary.*

4518. SEKHAR, A. C., and SHARMA, R. S. **New formula for variation of compressive strength with grain angle in timber.** *Curr. Sci.* 24 (1), 1955 (3–4). 4 refs. A.P.B.

The following formula is presented:

$$\sigma_{\parallel}/\sigma_{\theta} = 1 + P \sin^2 \theta$$

where P is a parameter depending on the species and the stresses, and other symbols are those in Kollmann's formula. The new formula is claimed to be simpler than either Kollmann's or the Hankinson formula. Some data based both on experimental work and on the use of the three different formulae are presented and compared.

4519. SAWADA, M. **[Studies on the mechanics of wood beams (Report 3). Load deflection curves in wood beams of rectangular cross-section.]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 77, 1955 (69–102). 9 refs. [Jap.e.]

Young's modulus and the tested compressive strength are used in basic equations in a study of the deflection of a simple wooden beam in the plastic region by area moments. The computed and actual deflections in *Picea jezoensis*, *Fagus crenata* and *Quercus crispula* are shown to agree with practical accuracy where the depth/span ratio is sufficient virtually to eliminate the effect of shear stresses. For softwood beams, the use of compressive strength at the proportional limit leads to decidedly greater accuracy. [Captions, formula calculations and worked examples are in English.]

4520. KITAHARA, K., KABURAGI, J., and MURAKI, M. **[A study on compression of wood.]** *Bull. Tokyo Univ. For.* No. 47, 1954 (1–64). 45 refs. [Jap.jap.e.]

A study, carried out chiefly on the early and late wood of *Cryptomeria japonica*, of compression effects got by simple loads, repeated loads of constant weight, constantly increasing loads, repeated application of the same series of increasing load etc. The displacement of two marks on the test pieces was measured by a strain gauge to 0·001 mm. under the various loadings, as was also the residual strain (compounded of a permanent, with or without a temporary, element). Crinkling and slip lines were examined anatomically, and alterations in the micellar structure of the tracheid walls (variation of fibril angle and distortion of parallels) by X-ray photogaphy. [There are 56 line figures with English captions and 37 tables of data.] *From authors' summary.*

4521. YAMAI, R. **[Stress-strain curves of wood. (Report 1). Stress-strain curves for compression perpendicular to grain (1).]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 77, 1955 (103–52). 22 refs. [Jap.jap.e.]

Test blocks of *Picea jezoensis* were used in a detailed examination of the mechanical properties and the manner of failure as affected by the orientation of the annual rings (*a*) and of the slope of grain (*b*) with respect to the loading axis. Deformation was measured by extensometer and dial gauge. Blocks were loaded with (*b*) constant at 90° and (*a*) varied as 0, 45 and 90; (*b*) was also held at 45° and (*a*) varied as 0, 30 and 90, and in a final treatment (*a*) was 0 or 90 and (*b*) 0°. Stress/strain curves are given in illustration of the results of these loadings, which are also presented in detailed tables, and the progress through the elastic to the plastic stage and permanent deformation is discussed with microscopic diagnosis of the failures (illustrated) in relation to the sliding of early wood etc. Strain recovery was least when (*a*) and (*b*) were both 90°.

4522. LIIRI, O. Puupintojen ja pintakäsittelyaineiden kulutuskestävyys Taber-laitteella määrättynä. **[The abrasion resistance of wood and wood finishes tested with the 'Taber' abraser.]** *Pap. ja Puu* 37 (4*a*), 1955 (131–7). [Fi.e.] P.R.

The electrically-powered Taber abraser (illustrated), of the American Taber Instrument Corporation, was used at the State Institute of Technical Research, Helsinki, on untreated Finnish Scots Pine,

Norway Spruce, Birch, hardboard, and plywood, and on some wood finishes. The purpose of the test was to determine the efficacy of the abraser for testing abrasion resistance and to determine some wearing properties of the test materials. The most important results are given in tables and figures with English legends. Sp. gr. greatly affects the resistance of untreated wood, loss in weight, and even more markedly loss in volume, decreasing with increasing sp. gr. Loss in weight, particularly from the transverse surface, was much more rapid for Pine and Birch when the surface had been cut by circular saw than when it had been planed or sanded. Other results show the effect on loss in weight of the duration of the test, and the loss in weight of different classes of hardboard and of synthetic finishes, cellulose lacquer, varnish and enamel paint; the last two had completely worn through after 1000 cycles. The abraser proved very suitable for the purpose and could also be used, with some reservations, to test flooring materials, although its action does not fully correspond to service wear in floors.

4523. YAVORSKY, J. M., and CUNNINGHAM, J. H. **Strain distribution in Maple glue block shear specimen as indicated by a brittle lacquer.** *For. Prod. J.* 5 (1), 1955 (80–4). 12 refs.

Observations were made on the strain patterns developing in a shear specimen cut from 2 face-glued boards, and coated with 'Stresscoat', a brittle varnish that cracks under tensile load, the principal tensile strain being perpendicular to a crack at any point in the crack pattern. It is concluded from this exploratory study that a qualitative picture of the main strains can be obtained but that, owing to the anisotropic nature of wood, quantitative measures of the main stress are difficult. Further research is needed.

4524. RADCLIFFE, B. M. **Shear deflection in timber beams and a method for the determination of shear moduli.** *Bull. Ind. agric. Exp. Sta.* No. 589, 1953. pp. 14. P.R.

Derives expressions for shear deflection (general case, concentrated load, uniformly distributed load), also for the effect of span/depth ratio on shear deflection, and for the calculation of the modulus of elasticity from flexure tests; finally, a method is developed of obtaining shear moduli from bending and compression tests.

813. *Wood Chemistry*

See also Nos. 4541–3.

4525. **List of [U.S. Forest Service] publications on chemistry of wood and derived products.** *Rep. U.S. For. Prod. Lab., Madison* No. 238, 1955. pp.58. P.R.

813.1. Chief Organic Constituents. Constituents of the Cell Wall

See also Nos. 4480–1, 4706, 4756.

4526. HARRIS, E. E. **Highlights in the chemistry of lignin 1943–1954.** *For. Prod. J.* 5 (1), 1955 (26–31). 99 refs. [U.S. Forest Products Laboratory, Madison.]

4527. SCHUBERT, W. J. Über Lignin und Lignifizierung. 14. Mitteilung. **[Investigations on lignin and lignification. XIV.]** *Holz Roh- u. Werkstoff* 12 (10), 1954 (373–7). 28 refs. [G.g.] P.R.

[Cf. *For. Abstr.* 14 (No. 3740).] A review of recent papers (including the author's). The sequence cellulose — glucose — ethanol — acetic acid — oxalic acid is established for the enzymatic decomposition of cellulose. Lignins obtained from different hardwoods and softwoods, and bagasse, by decomposing the cellulosic portion with brown-rot fungi, have been found to be chemically identical with each other and with 'native' lignin, while differing from 'chemical' lignins. The suggested explanation of the lignification process in plants is as follows: the carbohydrates in the cell are transformed enzymatically (via two-carbon-atom units) into oxyphenylpropane elements which can become guiacyl elements by methoxylation; these two aromatic structural elements can yield lignin by way of repeated condensation.

4528. BROWN, S. A., and NEISH, A. C. **Shikimic acid as a precursor in lignin biosynthesis.** *Nature, Lond.* 175 (4459), 1955 (688–9). 11 refs. [N.R.C. Prairie Regional Laboratory, Saskatoon.]

It has been shown that shikimic acid can serve as an aromatic precursor in wheat and in *Acer negundo*.

4529. HENDERSON, M. E. K. **Release of aromatic compounds from Birch and Spruce sawdusts during decomposition by white-rot fungi.** *Nature, Lond.* 175 (4458), 1955 (634–5). 4 refs. [Macaulay Institute for Soil Research, Aberdeen.]

During investigations into the decomposition of lignin by soil micro-fungi, it was found that a large number of them were able to decompose several aromatic compounds that are believed to be related to lignin. In an attempt to determine whether such compounds are released on biological decomposition of lignin, two wood-rotting fungi, *Polystictus versicolor* and *Trametes* [*Fomes*] *pini*, both white rots, were grown on Birch and Spruce sawdust. Vanillic acid alone was released from Spruce sawdust by both fungi, and both vanillin and syringaldehyde from Birch sawdust. These results conform with chemical analyses of lignin, which show the occurrence of guaiacyl and syringyl groups in hardwood lignin, and of guaiacyl groups alone in softwood lignin. These compounds are probably released by the action of extracellular enzymes produced by the wood-rotting fungi.

4530. MIGITA, N., NAKANO, J., and ITO, Y. **[On the lignin isolated with aqueous xylene-sulphonate solution.]** *J. Jap. For. Soc.* 36 (11), 1954 (343–6). 9 refs. [Jap.jap.e.]

Results are given of experiments with 'hydrotropic lignin' obtained from Beech and Spruce, i.e. lignins isolated with the aid of an aqueous solution of xylene sulphonate. Solubilities of these lignins in several solvents were similar to those of alkali lignin and phenol lignin. In the phloroglucinol-HCl reaction, Spruce lignin was fairly positive, while Beech lignin was negative both in this and in the Mäule reaction. The OCH_3 of the Beech lignin was 16·2–16·9%, that of the Spruce lignin 10·8–12·0%;

the OCH_3 contents of fully methylated lignins were 26·6% and 20·8% respectively. A two-stage mechanism of lignin dissolution during xylene-sulphonate treatment is proposed.

4531. PREY, V., WALDMANN, E., and STIGLBRUNNER, F. Zur Kenntnis des Alkalilignins. [**Alkali lignin.**] *Holzforschung, Berlin* 9 (3), 1955 (76–80). 14 refs. [G.g.e.] P.R.

It was found that the technical alkali lignin of Beech consists of two parts, the alcohol-insoluble fractions of which consist of lignin-hemicellulose complexes. It seems probable that at least the part of Beech wood substance that produces Klason lignin is a carbohydrate with unsaturated groups.

4532. VENER, I. M. [**The acid methods of isolation of lignins.**] *Trudy Instituta Gorjučih Iskopaemyh, Akademija Nauk SSSR* 2, 1950 (247–52). [Russ.] From *abstr.* in *Chem. Abstr.* 49 (6), 1955 (4286). P.R.

Lignins separated by mineral acids of varying concentrations have identical functional groups. They differ somewhat only in C content. Failure to remove hemicellulose introduces errors in the determination of lignins, indicating side reactions such as humin formation. Lignins separated with 42% HCl at 0° C. after first eliminating the hemicellulose and then completely methylating, have the same OCH_3 number as the previously methylated lignins from wood; this indicates that lignin is an actual component of wood and not a product of the action of concentrated acids on carbohydrates.

4533. LEVITIN, N., THOMPSON, N. S., and PURVES, C. B. **The oxidation of Spruce periodate lignin with sodium chlorite and with chlorine dioxide.** *Pulp Paper Mag. Can.* 56 (5), 1955 (117–130). 59 refs.

A study of oxylignin-β and oxylignin-γ, considered to be highly acidic, chlorinated, condensed quinones formed by the oxidative demethylation of phenolic units in the periodate lignin. Neither produced vanillin when oxidized with nitrobenzene in alkali.

4534. TREIBER, E., TOPLAK, H., RUCK, M., and RUCK, H. Physikalisch-chemische Untersuchungen an einigen Hemicellulosen. [**Physico-chemical investigations on some hemicelluloses.**] *Holzforschung, Berlin* 9 (2), 1955 (49–59). 51 refs. [G.g.e.] P.R.

A survey, including recent investigations on wood polyoses. Discusses the nature of the α- and β-cellulose. Reports some results of the authors' own research on Beech xylan, Boxwood hemicellulose, and *Cydonia vulgaris* cellulosic mucilage. *From authors' summary.*

813.2. Minor Organic Constituents. Extractives. Cell Contents

See also Nos. 3771, 4483, 4718.

4535. MAHESH, V. B., and SESHADRI, T. R. **Chemical components of commercial woods and related plant materials: Part II—The heartwood of *Pinus excelsa* Wall.** *J. sci. industr. Res., India* 13*B* (12), 1954 (835–41). 16 refs. D.S.I.R.

The following compounds have been found for the first time in a Himalayan sample of *P. excelsa*: galangin, izalpinin, pinobanksin-7-methyl ether, 2-hydroxy-4:6-dimethoxy chalkone, 4-hydroxy stilbene, 4-methoxy stilbene and pinosylvin dimethyl ether.

813.4. Chemical Effects of Heat. Chemistry of Thermal Decomposition

4536. SERGEEVA, V. N., and VAĬVADS, A. **Thermographic study of pyrolysis of wood and its constituents.** *Latvijas PSR Zinātņu Akademijas Vēstis, Riga* 1954 (9), (103–8). [Russ.] From *abstr.* in *Chem. Abstr.* 49 (8), 1955 (5831). L.S.

Comparison of thermal differential analysis curves of Birch wood (*A*), and cellulose (*B*), holocellulose (*C*), lignin (*D*), xylan (*E*) and xylose (*F*) isolated from *A*, indicate that in pyrolysis of *A* considerable interaction takes place between its components. Exothermic decomposition starts at 259° C., with 3 indistinct maxima at 389°, 414°, and 452°. *E* exhibits an exothermic reaction at 273°, endothermic reaction at 331°, and fresh exothermic and endothermic reactions above 390°. *C* shows characteristics combining *A* and *E*, with a shift in temperature. Comparison of *E* and *F* indicates that, in the decomposition of *E*, *F* is not formed. Pyrolysis of *F* proceeds by a mechanism different from that of glucose.

814. *Natural Durability. Old Wood. Fossilized Wood*

See also Nos. 4496, 4682, 4698–4700, 4708–9.

4537. **Weathering properties of N.S.W. timbers.** *Tech. Notes For. Comm.* (*Div. Wood Technol.*) *N.S.W.* 8 (1), 1954 (15).

Uncoated test panels of 36 New South Wales species were assigned to 5 classes on general appearance (freedom from rot, serious splitting and excessive softness). Among the Eucalypts commonly planted as exotics, *E. microcorys* is rated as very good, 9 others as good and 4 as satisfactory.

4538. SEN, J., and BASAK, R. K. **The nature of ancient wood. II. The structure and properties of well preserved tracheids and fibres.** *Bull. Torrey bot. Cl.* 82 (3), 1955 (183–95). 16 refs. O.B.D.

A study of the cell-wall structure of tracheids and fibres of some specimens of ancient buried wood (*Pinus sylvestris* and *Shorea robusta*).

4539. KOHARA, J. [**Studies on the durability of wood. V. Shrinkage and swelling of old timbers, about 300–1300 years old (*Chamaecyparis obtusa*).**] *Repr.* from *Scientific Reports of the Saikyo University, Kyoto: Agriculture* No. 5, 1953 (81–8). 12 refs. [Jap.e.] P.R.

Graphs show shrinkage/swelling cycles of timber of different ages when subjected to alternate effect of 0 and 100% air humidity. The amount of shrinkage decreases with age.

4540. KOHARA, J. [**Studies on the permanence [durability] of wood. VI. The change of mechanical properties of old timbers (*Chamaecyparis obtusa*).**] *Repr.* from *Scientific Reports of the Saikyo University, Kyoto: Agriculture* No. 6, 1954 (164–74). 9 refs. [Jap.e.] P.R.

[Cf. *For. Abstr.* 15 (No. 4115).] Samples taken from timber constructions of temples 360–1300 years old were tested for mechanical properties. The tabulated and graphed results show that the general trend of change in strength properties closely resembles that of wood heated at low temperature.

4541. KOHARA, J. **[Studies on the permanence of wood. VII. The influence of age on the components of wood (*Chamaecyparis obtusa*).]** *Repr.* from *Scientific Reports of the Saikyo University, Kyoto: Agriculture* No. 6, 1954 (175–82). 8 refs. [Jap.e.] P.R.

It was found that, as the age of the wood increases, there is an increase in the quantity of extracts extracted with water, ethanol/C_6H_6, and 1% NaOH, and a decrease of holocellulose and α-cellulose, while the amount of pentosans and lignin remains practically constant. The changes resemble those found in wood heated at low temperature.

4542. SKRIGAN, A. I. O himičeskom sostave drevesiny sosny tysačeletnogo vozrasta. **[The chemical composition of Scots Pine wood thousands of years old.]** *Dokl. Akad. Nauk SSSR* 100 (6), 1955 (1135–7). 11 refs. [Russ.] A.P.B.

Presents in a table and graph some analytical data for wood specimens varying in age from 1 month to 140–150 thousand years, the latter derived from buried peat-bogs of the interglacial period and representing both stem (heart- and sapwood) and root wood. Results show progressive increase of the element C and of the lignin portion of the wood, with parallel decreases of H, O + N, and cellulose and hydrolysed components. Viscosimetric tests showed a corresponding decrease in the molecular weight and degree of polymerization in the old wood.

4543. VAROSSIEAU, W. W., and BREGER, I. A. **Chemical studies on ancient buried wood and the origin of humus.** *Proceedings of the 3rd Congress on Stratigraphy and Geology of the Carboniferous, Heerlen 1951*, 3 (2), 1952 (637–46). 14 refs. [E.e.] From *abstr.* in *Chem. Abstr.* 48 (19), 1954 (11260). P.R.

Ancient buried wood was studied chemically to determine the course of degradation and the origin of humic substances. Piles, exposed when Rotterdam was bombed in 1940, were suitable for this work since they had been buried for up to 600 years under anaerobic conditions. By analysing various piles for cellulose, lignin and pentosans, it was possible to demonstrate that the % of cellulose decreases and that of lignin increases with duration of burial. Pentosans are apparently slowly decomposed. Analysis of 1-mm. and 2-mm. layers of the piles showed the degradation to be greatest in the outermost layers and to decrease toward the interior of the piles. The lignin concentration in the degraded wood was ascertained by detailed determinations of OCH_3 content. To confirm the results, lignin was isolated quantitatively from the degraded wood and the methoxyl content of the isolated lignin was determined. The OCH_3 content of the lignin was found to be subnormal in the outer layers. The results of these studies point to lignin as the major progenitor of most coals, since the rapid degradation of cellulose in wood buried under anaerobic conditions seems to preclude cellulose as a major contributor to coal substance. These conclusions confirm previous anatomical studies on these samples.

4544. GALPIN, E. A. **The age of the Zimbabwe ruins.** *Trees S. Afr.* 6 (3), 1954 (3–4). 1 ref.

Tests of the radio-active C in *Spirostachys africana* timber from these ruins indicate an age of 1252–1361 years, but other archaeological evidence places the date of construction of Zimbabwe at between the 12th and 16th centuries A.D. The author considers that this disparity could well be explained by the wood being 500–1000 years old when set in the work. Forty years' observations on many trees growing at Naboomspruit (N. Transvaal), both living and dead, show the very slow growth (38 rings/ in.) of the former and the great durability of the latter, some of which could have been dead for 500–1000 years.

815. *Effect of Growth Factors on Structure and Properties*

See Nos. 4075–6, 4403, 4484–5, 4489, 4507, 4510.

82. CONVERSION, SHAPING, ASSEMBLY AND FINISHING OF WOOD: GENERAL

4545. FUKUI, H., and KIKATA, Y. **Studies on cut surfaces.** *Trans. 62nd Mtg. Jap. For. Soc.* 1953 (212–5). [Jap.?] From *abstr.* in *Rec. Res. Fac. Agric. Univ. Tokyo* No. 4, 1955 (82–3). [E.]

Diagrams are given illustrating the effect of rectilinear cutting, planing, sawing, sanding and drilling on cell-wall shape at the cut surface.

4546. Zur Technischen Messe 1955. Hannover 24.4. bis 3.5. **[Technical Fair, Hanover, 1955, Apr. 24 to May 3.]** *Holz Roh- u. Werkstoff* 13 (4), 1955 (121–60). [G.] P.R.

This issue contains the following articles dealing with some of the machines exhibited: (1) Preparation of wood and wood waste by comminution and blast-screening (*W. Beushausen*); Tendencies in the development of wood-planing machines (*F. Haase*); (3) Development of cylindrical grinding machines in Germany and the U.S.A. (*Z. Hultkvist*); (4) Discontinuous and continuous methods and plants for the manufacture of wood chipboards (*K. Steiner*), and (5) Considerations on the industrial barking of wood (*R. Bott*).

821. *Barking*

See also Nos. 4119–20, 4134–6, 4546, 4743.

4547. LIIRI, O. Sahatukkien koneellisesta kuorinnasta. **[Barking machines and the barking of sawlogs.]** *Pap. ja Puu* 37 (4*a*), 1955 (95–109). [Fi.e.] P.R.

Describes methods and machines used for barking sawlogs. Compares different types of machine. Discusses requirements for machines, barking costs and the utilization of bark. *From author's summary.*

822. *Saws and Sawing*

See also Nos. 4545, 4776.

4548. ALKEEV, N. F. Mehaničeskaja razdelka drevesiny na skladah. **[Mechanical primary conversion of wood at log depots.]** Goslesbumizdat, Moscow and Leningrad. 1951. pp. 283 + 2 dgms. 25 refs. [Russ.] (*Biblioteka Lesozagotovitelja* No. 35.) Price *Roubles* 10·10 (bound), 8·60 (unbound).

Contains chapters on: main timber assortments; log depots; the cutting tools of machines for converting wood; general information on the types of machine used and their operation; chain saws; circular cross-cut saws; reciprocating cross-cut saws; circular saws for rip-sawing; frame saws; bandsaws; mechanical barking; mechanical cleaving; machinery and installations for transport in depots; general notes on the organization of primary mechanical conversion.

4549. MÉGILLE, X. DE. Un nouvel appareil à conditionner le bois de chauffage. **[A new appliance for cutting firewood.]** *Rev. Bois Appl.* 10 (5), 1955 (25). [F.]

Illustrated description of a machine consisting of 6 vertically arranged chain saws and a chain conveyor, capable of sawing 1 cu.m. of wood into 210 blocks within 12 min.

4550. **Circular saws for woodworking and their attachment.** *Brit. Stand.* No. 411, 1954. pp. 17. Price 3*s*.

Covers: nomenclature; material; hardness; range and tolerances of diameter and thickness; centre holes, driving pin holes, spindles and pins; side error; tooth setting; finish; and tension.

4551. HORDERN, R. H. **The application of technology.** *Wood* 20 (4), 1955 (163–5).

A detailed argument for the circular in preference to the band saw. The saving of kerf in the latter is generally more than offset by the losses in planing entailed in making good its more inaccurate surfaces.

4552. **'Stellite' tipped band saws.** *Timb. Tr. J.* 212 (4098), 1955 (95–6).

Describes a simple method of depositing the hard 'Stellite' alloy on the teeth of standard bandsaws to form a wear-resistant tip which remains sharp up to 10 times as long as a normal tooth. The teeth can be sharpened 8–10 times before re-tipping is necessary. The method is a result of collaboration between the saw maintenance department of Montague L. Meyer Ltd. with Deloro Stellite Ltd., Shirley, Birmingham.

4553. REINEKE, L. H. **Why joint saws?** *For. Sci.* 1 (1), 1955 (31–6).

Discusses the distribution of energy expended in rip-sawing, modifications of the wood in the path of the saw, and fluctuations in energy from tooth to tooth as recorded by the pendulum dynamometer, and shows that though the material cut and the cutting act may introduce variations in saw misbehaviour, the misbehaviour that is due to variations in force from tooth to tooth may be corrected in a properly jointed saw merely by altering the feed rate.

4554. CHARDIN, A. **Can a single type of sawtooth be used for all species of wood?** *Transl. For. Prod. Lab., Can.* No. 84, 1955. pp. 12. Transl. from *Bois For. Trop.* No. 33, 1954 (41–50). [See *For. Abstr.* 15 (No. 4132).] Limited distribution. P.R.

823. *Planing, Cutting of Mouldings. Chiselling, Mortising and Tenoning. Boring. Turning*

See also No. 4545.

4555. KOCH, P. **An analysis of the lumber planing process.** *Abstr. of thesis*, in *Dissert. Abstr.* 15 (2), 1955 (248–9). [University of Washington.] O.R.S.

Gives results of tests on the effect on cutter-head h.p. requirements of: diameter of cutting circle, number of knives, rake and clearance angles, joint width, cutter-head type, angle between rotational axis of cutter-head and direction of feed, feed speed, direction of cutter-head rotation, sp. gr., quarter- or flat-sawn stock and moisture content.

4556. BLOOR, T. **Wavefields in woodwork.** *Woodwkg. Ind.* 11 (10), 1954 (579–81, 584). P.R.

The 'wavefield' (defined as the maximum number of cutter marks per in.) should never exceed 25. The effect on it of cutting speed, approach angle, and cutter and knife setting are discussed, and the practical speed limits stressed.

4557. BABCOCK, C. L. **How to select best speeds for cutterheads.** *Wood, Chicago* 60 (4), 1955 (26, 54, 56). P.R.

The quality of the cutting work is determined by the number of visible marks per in., while efficiency of operation is governed by the number of marks per min. A table is annexed for determining the rate of feed to produce a given number of knife marks.

4558. HAASE, F. Ein moderner Doppel-Endprofiler und seine Einsatzmöglichkeiten bei der Serienfabrikation von Möbeln. **[A modern universal double end-tenoner and its possibilities in mass production of furniture.]** *Holz Roh- u. Werkstoff* 12 (10), 1954 (385–90). [G.g.] P.R.

Illustrated description of a modern German machine.

824. *Forms of Joint. Jointing and Assembly*

824.1. Nailed Joints

See also Nos. 4615, 4622–3.

4559. STERN, E. G. **Effectiveness of underlayment nails.** *Bull. Wood Res. Lab. Va. polyt. Inst.* No. 18, 1954. pp. 6 + [1]. P.R.

Tests show that a properly threaded nail is more effective for fastening plywood underlayment than the plain-shank nail with fewer nails/lb.

4560. STERN, E. G. **Effectiveness of nails versus staples for fastening insulating sheathing.** *Bull. Wood Res. Lab. Va. polyt. Inst.* No. 19, 1955. pp. [6]. P.R.

Presents the results of comparative tests with staples, plain-shank nails, Stronghold nails, and Stronghold Screwnails, the holding power increasing in this order.

4561. KUENZI, E. W. **Theoretical design of a nailed or bolted joint under lateral load.** *Rep. U.S. For. Prod. Lab., Madison* No. *D*1951, 1955. pp. 24 + 3 dgms. + 4 gphs. 4 refs. P.R.

Presents a theoretical method for determining the allowable lateral load of a joint having a single nail or bolt. An appendix gives several examples illustrating the application of the method to specified joints. *From author's summary.*

4562. HUNTINGTON, W. C., OLIVER, W. A., JACKSON, M. W., and COX, W. T. **The distribution of concentrated loads by laminated timber slabs.** *Bulletin, Engineering Experiment Station, University of Illinois, Urbana* No. 424, 1954. pp. 69. P.R.

Contains the results of an investigation on 119 laminated timber slabs constructed of laminae 2 × 4, 2 × 6, and 3 × 6 in., and tested on spans of 3, 4½ and 6 ft. Variables considered were the type of fasteners and their location in the laminate, the span length, the number of laminae in the slab, the species (Yellow Pine, Redwood, or Douglas Fir), the number of laminae to which the load was applied, and the effect of repeated loads. The test results were analysed and compared on the basis of the effective number of laminae, i.e. the number of laminae which, when considered as equally stressed, will produce the same maximum fibre stress as would be obtained if the actual distribution of the load among the various laminae were considered. For example, if the effective number of laminae is 4, each loaded lamina should be designed to carry ¼ of the load. One of the conclusions reached is that the important factor in the distribution of concentrated loads among the laminae of a slab is the type and arrangement of fasteners, the wood species being of small importance. A common specification of 30d nails staggered at 18-in. intervals for nailing laminae together, does not develop the strength of laminated floors to the fullest extent readily obtainable. Bolts and pipe dowels were somewhat more effective than 30d nails arranged in the same pattern, but their superiority is too small to justify their greater cost. The most satisfactory spacing of nails was found to be 9 in. alternating between the top and the bottom of the slab (i.e., staggered); the spacing may be increased to 18 in. near the supports without any reduction in strength when a load at the centre line of span only is considered. *From authors' summary.*

4563. RADCLIFFE, B. M., and GRANUM, H. **Design of nail-glued plywood gusset plates and solid wood splice plates for softwoods.** *Bull. Ind. agric. Exp. Sta.* No. 613, 1954. pp. 15 + 15 photos. P.R.

Presents methods for gluing plywood gusset plates and solid wood splices with common nails, and gives allowable shear stresses for plywood. The research was done with casein glue and Douglas-Fir wood and plywood. Shear failures of gusset plates and solid wood tension splices are illustrated and described.

4564. SUDDARTH, S. K. **A spreader for use in structural nail-gluing.** *Circ. Ind. agric. Exp. Sta.* No. 408, 1954. pp. 8 + 11 dgms. 1 ref. P.R.

Illustrated description of the design and operation of the Purdue spreader designed for work in structural nail-gluing. [Cf. preceding abstract.]

824.8. Glues and Gluing

See also Nos. 4563–4, 4605–9, 4614–5, 4626, 4762–3.

4565. **Drying and conditioning glued joints.** *Rep. U.S. For. Prod. Lab., Madison* No. 475, 1955. pp. 5 + 3 tbls. P.R.

A general description of the conditioning of glued thick stock and of drying plywood. Tables attached include the calculated % of moisture added to wood in gluing 5-ply constructions or panels, and plywood drying schedules.

4566. HYLER, J. E. **Glues and gluing. Parts 56 to 62.** *Sth. Lumberm.* 190 (2375–2381), 1955 (49 . . . 52, 66; 39 . . . 42; 43 . . . 48; 41 . . . 44; 45 . . . 48; 33 . . . 36; 45 . . . 49).

Mainly hot-plate pressing.

4567. OLSON, W. Z. **Gluing characteristics of Chinquapin, Tanoak, California Laurel, Madrone.** *Rep. U.S. For. Prod. Lab., Madison* No. 2030, 1955. pp. 3 + 4 tbls. P.R.

Results of gluing tests are tabulated for *Castanopsis chrysophylla, Lithocarpus densiflorus, Umbellularia californica* and *Arbutus menziesii.*

4568. SAUER, E. Über das Verhalten der Bindung von Holzleimen bei Dauerbeanspruchung. II. **[Behaviour of the wood-glue bond during continuous stress. II.]** *Holztechnik* 35 (2), 1955 (56–9). 1 ref. [G.g.] P.R.

[Cf. *For. Abstr.* 16 (No. 983).] Presents the results of tests on gluten and synthetic-resin (formaldehyde-urea and polyvinyl-acetate) glues, by the new testing method.

4569. MARRA, A. A. **An analysis of a wood adhesive test method using a cross-lap specimen.** *Abstr. of thesis*, in *Dissert. Abstr.* 15 (4), 1955 (482–3). [University of Michigan.] O.R.S.

Cross-lap specimens were studied to determine, in particular, their sensitivity to a number of factors (e.g. rate of loading, block thickness, moisture content, flaws in the joint, pressure, assembly time, and age of the adhesive) influencing bond strength. It is concluded that a test method using the cross-lap specimen holds promise for evaluating wood adhesives, particularly when many variables are to be introduced into an experiment.

4570. BAKER, A., and HOCKNEY, M. D. G. **Tropical exposure tests on wood assembly adhesives at T.T.E., Nigeria. Fourth interim note.** *Technical Note, Royal Aircraft Establishment, Farnborough* No. *Chem.* 1244, 1955. pp. 11. 6 refs. P.R.

Tropical trials of assembly adhesives by the boxed test-piece technique have been proceeding for 3 years. Specimens have been withdrawn for strength testing, in comparison with temperate controls, at suitable periods. The results are discussed in the light of contemporary F.P.R.L.-sponsored trials of plywood and wood-assembly adhesives.

4571. **Blood albumin glues: their manufacture, preparation, and application.** *Rep. U.S. For. Prod. Lab., Madison* No. 281–2, 1955. pp. 6. 4 refs. P.R.

Several formulae for glue mixes incorporating blood albumin glues are given, including their application and pressing.

4572. SERGEENKO, G. A. **[Improvement of properties of casein glue in plywood manufacture.]** *Derev. lesohim. Prom.* 2 (11), 1953 (23–4). [Russ.] From *abstr.* in *Chem. Zbl.* 125 (33), 1954 (7571). [G.] L.S.

Properties of casein glue are considerably improved if 2·5 parts $CuSO_4$ are added to 100 casein, 15 CaO and 600 water: the water-resistance of glued pieces is increased, and so is the durability of the glue solution.

4573. SOINÉ, H., and ENZENSBERGER, W. Untersuchungen über kochfeste Verleimungen mit 'Pressal 2060'. **[Investigations on boil-resistant gluing with 'Pressal 2060'.]** *Holz-Zbl.* 81 (49), 1955 (605). [G.g.]

Presents results of shear-strength tests on 3-ply test pieces (DIN 53255) in accordance with B.S.1203, category AX 100. No failure was observed during tests.

4574. BLOMQUIST, R. F., and OLSON, W. Z. **Durability of fortified urea-resin glues in plywood joints.** *For. Prod. J.* 5 (1), 1955 (50–6).

The addition of 10% of resorcinol or 20% of melamine resin, the lowest proportions studied, increased the resistance of urea-resin joints to high temperature and humidity in the laboratory and to exterior weathering. Some further improvement was generally obtained in proportion to additional amounts, but none of these combinations fully equalled the performance of a melamine-resin glue.

4575. KÖHLER, R., and HARDER, H. (to Henkel & Cie, G.m.b.H.). Verfahren zur Verleimung von Holz und ähnlichen Werkstoffen. **[Method of gluing wood and similar materials.]** *German Patent* No. 822,865, Sept. 14, 1953. pp. 2. [G.] P.O.

The glues used are aqueous solutions of condensation products of phenol and formaldehyde, containing sulphonic groups, in the presence of acids.

4576. SHELTON, F. J., and STENSRUD, R. K. **The gluing of hardboards with polyvinyl acetate emulsions and resorcinol-formaldehyde resins.** *For. Prod. J.* 5 (2), 1955 (124–7).

Characteristics, advantages and disadvantages of these adhesives are discussed and some test results are given.

825. *Cleaving. Adzing. Mechanical Comminution*

See Nos. 4118, 4546, 4743.

827. *Bending. Moulding (other than by Cutting)*

See also No. 4609.

4577. TURNER, N. (to Imperial Trust for the Encouragement of Scientific and Industrial Research). **Improvements in and relating to bends uniting side pieces of timber.** *Brit. Patent* No. 721,205, Jan. 5, 1955. pp. 4 + 3 dgms. P.R.

The bend comprises a radially continuous bent filler-piece of roughly the same thickness as the side pieces and of an easily bent material, extending at least round the curve, and an outer lamina glued to the filler-piece and extending beyond it and into union with the timber on either side of the bond.

829.1 *Finishing*

4578. ORTH, R. Bleichen von Holz. **[Bleaching of wood.]** *German Patent* (*East Germany*) No. 1953, Nov. 22, 1952. [G.] From *abstr.* in *Chem. Zbl.* 125 (24), 1954 (5425). [G.] L.S.

Blue-stained wood is first treated with an aqueous solution of KOH or NaOH, causing the micellar structure of the plant and fungal membranes to swell, and then the alkali-impregnated fungal hyphae are treated with a H_2O_2 solution.

4579. KRASNOVSKAJA, O. N., and NIKITIN, V. M. **[Alkali lignin as wood stain.]** *Derev. lesohim. Prom.* 3 (5), 1954 (7). [Russ.] From *abstr.* in *Holzforschung, Berlin* 9 (3), 1955 (94). [G.] P.R.

Sulphate-pulp liquor is treated with H_2SO_4, heated to 90° C., and the precipitated lignin filtered, washed and dried. This alkali lignin is dissolved with an addition of alkali. By brushing or spraying, a walnut colour is obtained.

4580. GALLAK, V. M. **[Chemical staining of wood with nitrogen oxides.]** *Derev. lesohim. Prom.* 3 (4), 1954 (10–1). [Russ.] From *abstr.* in *Holzforschung, Berlin* 9 (3), 1955 (94). [G.] P.R.

Yellow tones are obtained by using NO_2 for ca. 5 min.; a brown coloration is obtained by treating with NO, wood previously soaked in a $FeSO_4$ solution.

4581. **Knot boring and plugging of Radiata Pine.** *Aust. Timb. J.* 21 (3), 1955 (192 . . 198).

Prepared by the New Zealand Forest Service, the article deals with the importation and operation in Australasia of a Raimann machine for increasing the supply of boards suitable for flooring, weatherboarding, linings, shelving and joinery. Applications are being made to the standards institutes of Australia and New Zealand to have plugged timber accepted in standard grading rules. In parts of Europe plugs are accepted as 'no defect' in certain grades and products.

4582. BROWNE, F. L. **Swelling of paint films in water, III. Absorption and volumetric swelling of bound and free films from air of different relative humidities. IV. Effect of thickness of film and pigment volume of paint. V. Effects of different pigments.** *For. Prod. J.* 5 (1–3), 1955 (92–6; 142–6; 192–200). 24 refs.

Cf. *For. Abstr.* 15 (No. 2903; 16 (No. 3444).

4583. HEEBINK, B. G., SEIDL, R. J., LAUGHNAN, D. F., and BLOMQUIST, R. F. **Some potentialities of overlaid lumber.** *For. Prod. J.* 5 (2), 1955 (97–101).

Discusses research at the Forest Products Laboratory, Madison, using mainly White Pine overlaid on both sides with a resin-impregnated kraft sheet.

The overlays served to mask defects in the wood and to reduce swelling. Results are likely to vary with species or wood density. Performance of painted overlaid boards during 2 years' outdoor exposure was excellent.

4584. STILLINGER, J. R., and WILLIAMS, W., JR. **Strength properties of paper-covered veneer from true Fir and white-speck Douglas Fir.** *For. Prod. J.* 5 (1), 1955 (56–61).

The materials tested were: Ponderosa Pine apple-box shooks $\frac{5}{16}$-in. thick; paper-covered $\frac{1}{8}$- and $\frac{3}{16}$-in. Douglas Fir veneer infected with *Fomes pini* and showing different degrees of white speck or honeycomb (illustrated); and paper-covered sound veneer, $\frac{1}{12}$ or $\frac{1}{8}$ in. thick, of true Fir (*Abies* sp.). Results of tests on 820 samples for puncture resistance, lateral or direct nail-withdrawal resistance, modulus of rupture and modulus of elasticity, were analysed statistically. Modulus of rupture and modulus of elasticity were similar for all materials except the $\frac{1}{8}$-in. Douglas with a large amount of honeycomb and the $\frac{1}{12}$-in. *Abies* sp., which showed values similar to each other but lower than those from the rest of the material. All materials gave the same average results for nail-holding tests. The Pine shooks and the $\frac{3}{16}$-in. Douglas veneers exceeded the limits of the puncture-testing machine and could not be tested. In Douglas Fir, puncture resistance decreased with increasing honeycombing. In tests on specimens conditioned to two different relative humidities, those at 65% r.h. gave higher values than those at 85% except in tests of puncture resistance, in which most material gave higher values for the higher r.h. Comparisons of the various materials showed that $\frac{1}{8}$-in. Douglas veneer with light and medium amounts of white speck gave test values equal to or better than the $\frac{1}{12}$-in. *Abies* veneer (used for one-piece boxes) for all properties, and the $\frac{3}{16}$-in. Douglas veneer with a medium amount of white speck compared favourably with the Pine shook; the Douglas Fir could probably be used for products similar to those from these two types of material.

4585. Japan-Holzfurnierpapiere. **[Japanese paper-backed veneer.]** *Holz-Zbl.* 81 (46), 1955 (579). [G.]

Brief illustrated description of sheets made in Japan from shavings 0·03 mm. thick and 5–10 cm. wide of *Paulownia imperialis* sapwood from logs soaked in water for several months and dried. The shavings are glued to soda-pulp paper. After drying, the sheets are compressed between zinc plates and acquire a silky gloss. They are used for various decorative purposes.

83. TIMBER MANUFACTURING INDUSTRIES AND PRODUCTS. USES OF WOOD AS SUCH

831. *Fuelwood and Various Types of Rough Timber*

See also Nos. 3953, 4392, 4549, 4594, 4654, 4666, 4671–2, 4675, 4677–84.

4586. CSUHAY, I. **Statics and moment of inertia of twin wood poles.** *Elektrotechnika, Budapest* 47 (12), 1954 (355–9). [Hu.] From *abstr.* in *Elect. Engng. Abstr.* 58 (688), 1955 (No. 1531). L.S.

A revision of the (Hungarian) draft standard specifications for overhead power lines is suggested. In support of this, a critical analysis is made of conventional methods of calculating the stresses and moments of inertia of twin wood poles. A comparison of costs is made for single and twin wood poles, much in favour of the latter.

4587. HANNA, O. A. **Laminated crossarms.** *For. Prod. J.* 5 (2), 1955 (127–30). 5 refs.

Different types of laminated cross-arm produced since 1946 are described and discussed, and figures of comparative strengths of solid and laminated cross-arms are tabulated. Graphs are given showing the effect on strength of joints in different laminations at varying distances from the midpoint of the arm.

4588. SCHNELL, R. L., and ALLEN, J. C. **Grading rules for Southern Yellow Pine fence posts.** *Tech. Note Tenn. Vall. Auth.* No. 17, 1953. pp. 3 + 6 drawings.

832. *Mills, Their Functions and Products*

832.1. Sawmills and Planing Mills

See also Nos. 4446, 4548 *et seq.*, 4733.

4589. HYLER, J. E. **Modern sawmilling. Parts 17 to 23.** *Sth. Lumberm.* 190 (2375–2381), 1955 (55 . . . 58; 47 . . . 53; 61–2; 47–8; 53–4; 45 . . . 48; 51 . . . 56).

Saw carriages.

4590. THUNELL, B. **Research and development in the field of sawmill technique.** *Transl. Commonw. sci. industr. Res. Organ. Aust.* No. 2394, 1955. pp. 17. 10 refs. Transl. by M. Slade from *Holz Roh- u. Werkstoff* 11 (11), 1953 (420–9). [See *For. Abstr.* 15 (No. 2910).] P.R.

4591. WOLRYCHE-WHITMORE, G. C.; SPENCER, A. V. **Pros and cons of private estate sawmills. 1. The value of a sawmill on a private estate. 2. The case against estate sawmills.** *Quart. J. For.* 49 (3), 1955 (181–90 + 4 photos).

4592. **Ari-sawing in Scotland.** *Timb. Tr. J.* 213 (4111), 1955 (117–20).

An illustrated account of the sawmill and the progressive kiln (with schedule) constructed on the Swedish 'Ari' principle at Strachur, Argyll, for the economic conversion of relatively small softwood logs from thinnings in 22,000 acres of Forestry Commission forests in the Cowal Peninsula. The project is jointly financed by the Commission and a private firm.

4593. **[Some portable sawmills.]** *Equipm. Note, FAO* No. *D*.3.54, 1954. pp. 3.

Describes with photographs: (1) a mobile circular-saw mill (Corinth Machinery Co., Corinth, Mass., U.S.A.); (2) a double-rack bench (W. Reid Ltd., Forres, U.K.); (3) Forestière C.D.4 portable band-saw (Ét. C. D., Puteaux, France); mobile vertical log frame-saw (Emil Sachs, Bavaria-Ring 4, München 15, Germany).

4594. VEAZEY, T. S., JR. **New methods in packaging and handling planks and timber.** *For. Prod. J.* 5 (1), 1955 (25*A*–29*A*).

A review of methods and equipment at plants connected with the Anaconda copper mines and producing mine timber.

4595. LANE, P. H. **Overrun from Yellowpoplar [*Liriodendron tulipifera*] sawlogs: some factors affecting overrun at circular mills.** *Tech. Note Tenn. Vall. Auth.* No. 21, 1954. pp. 14. 7 refs.

4596. WALTER, C. S., and HERRICK, A. M. **Sawing time for hardwood logs.** *Sth. Lumberm.* 190 (2378), 1955 (58).

Results of studies at 4 sawmills (3 circular-saw and 1 band-saw mill), given in graphs, show clearly the steep drop in length of time required to saw larger logs (e.g. mill No. 3 took 73 min. to saw 1000 bd. ft. of logs averaging 50 bd. ft. and only 42 mins. for those averaging 100 bd. ft.).

4597. LITTLER, G. F., and ADKINS, B. **Studies in sawmill economics. The milling of hardwoods in S.E. Queensland.** *Aust. Timb. J.* 21 (1), 1955 (40 . . . 61).

Based on runs of ca. 3 working days at 13 mills cutting Eucalypts (12 species), *Tristania* and *Syncarpia*, a detailed analysis of the data is presented in 25 tables and 2 graphs along with the Queensland grading rules for building and flooring timbers. The following useful relations were established for the development of a hardwood log price structure: (1) A log's sawn recovery could be satisfactorily determined as a function of its gross volume and defect content. Milling time was a simple function of the log's gross volume, independent of defect of the type encountered. (2) Green off-saw recovery and production rate were the same for all logs of the same size and defect content, irrespective of species, but species showed wide differences in the average amount of defect. (3) Defect occurred primarily as faulty heart ('pipe'). Pipe had no significant influence on milling time and the difference between sound and defective logs in relation to production rate was a difference in recovery performance—probably a result of the milling pattern. (4) There was little improvement in average sawn length as log length increased from 18 to 20 ft.

Total recovery is broken down to sawn sizes and grades and the influence of log dimensions on these distributions is examined.

4598. WRIGHT, G. W. **The effect of log girth on production and recovery in a Jarrah [*Eucalyptus marginata*] sawmill.** *Aust. For.* 18 (2), 1954 (93–103 + 1 photo).

Studies in a W. Australian Jarrah sawmill showed that log break-down rate was increased by 85%, and sawn-production rate by 24%, by an increase of 3 ft. 6 in. in log girth (from ca. 4 ft. 9 in. to 8 ft. 3 in.). At the same time, sawn recovery was raised by ca. 4% of the Hoppus log volume. Based on all personnel under the mill roof, a sawn output of 45½ bd. ft. per man-hour was obtained. Recovery averaged 42% (Hoppus basis). *From author's summary.*

4599. THUNELL, B., and TAPLIN, I. **Utbytet vid försågning av krokigt timmer. [Outturn in sawing crooked timber.]** *Medd. svenska TräforsknInst.* (*Träteknik*) No. 62*B*, 1954. pp. 12 + 2 + 8 tbls. + 10 gphs. [Sw.] P.R.

Over 500 logs were used in a trial run to determine the effect of crook on outturn. Tabulated results show volume by scaling, outturn of different grades of boards and of waste, and value outturn, for straight or crooked logs of different dimensions. With a crook of 65 mm./15 ft. timber length and a top diam. of 6–8 in., the volume outturn was 10% below that for straight timber; the difference in value outturn between the two categories, including both sawn goods and chips, was only 5·4%.

4600. TODD, A. S., JR., and ANDERSON, W. C. **Size, volume, and weight of Pine slabs and edgings in the South Carolina Piedmont.** *Sta. Pap. Stheast. For. Exp. Sta.* No. 49, 1955. pp. 21.

Tabulates figures showing the sizes of Pine (predominantly Shortleaf with some Loblolly) slabs and edgings produced at sample small sawmills, and the volumes and weights of wood and bark components.

832.2. Veneer and Plywood Mills, including the Manufacture of Composite-Wood Assemblies

See also Nos. 4447, 4464, 4516, 4562–3, 4565 *et seq.*, 4584–5, 4587, 4613–6, 4623, 4626, 4628, 4737, 4739, 4774.

4601. LE RAY, J. Bois tropicaux et contreplaqué. **[Tropical timbers and veneer.]** *Bois For. Trop.* No. 40, 1955 (35–48). [F.f.e.span.]

Summarizes information collected by FAO on the production of veneer in tropical countries and the importation of tropical veneer logs by the U.S.A. and European countries.

4602. RINNE, V. J. Purilas vaneriteollisuudessa. **[The core in the plywood industry.]** *Pap. ja Puu* 37 (3), 1955 (71–2). [Fi.e.] P.R.

General practice in Finland has been to peel plywood logs to 80-mm. diam. and then to cut the core into pieces and to continue peeling on smaller rotary cutters to avoid bending the core. A device supporting the core has been designed which allows continuous peeling to 60 mm. *From author's summary.*

4603. STERLIN, D. M. **[Shrinkage of peeled [rotary] veneer.]** *Derev. lesohim. Prom.* 2 (9), 1953 (18–21). [Russ.] From *abstr.* in *Chem. Zbl.* 125 (24), 1954 (5424). [G.] L.S.

When Birch veneer is dried in a desiccator at different relative humidities and a temperature of 20° C., shrinkage begins at the fibre-saturation point and varies linearly [with moisture content?]; in drying pressses at 140–145° C., shrinkage begins at ca. 45% m.c. and its variation is non-linear. Tangential shrinkage decreases, and radial shrinkage increases with thicker veneers.

4604. LUTZ, J. F. **Causes and control of end waviness during drying of veneer.** *For. Prod. J.* 5 (2), 1955 (114–7). [U.S. Forest Products Laboratory, Madison.]

Experiments at Madison on drying rates of 2 × 4-ft. sheets of rotary-cut veneer showed that end surfaces dry more rapidly than the main part of the sheet; fibres in the end portion are restrained from shrinking by the rest of the sheet and are set in an expanded size, and when the rest of the sheet dries it shrinks more than the ends and exerts a compressive force, relieved by the formation of waves. Drying splits did not develop in these experiments in which $\frac{1}{16}$-in. and thicker veneer was dried in a mechanical drier on the day of cutting. Waviness of the veneer ends was measured in $\frac{1}{100}$ in., using a device incorporating a micrometer, and these measurements were used to check visual estimates of degree of waviness. End-coating the bolts with e.g. rubber-base end coatings, aluminium paint and synthetic resins, and coating the end in. of the veneer with water solutions of diethylene glycol, glycerine and a saturated salt solution, failed to reduce waviness. Lapping veneer ends $\frac{1}{4}$–$\frac{1}{2}$ in. during drying, or adding moisture to the ends by dipping them in water before and during drying, reduced waviness considerably, and proved equally effective. Some other factors causing waviness are discussed.

4605. NORTHCOTT, P. L. **Bond strength as indicated by wood failure or mechanical test.** *For. Prod. J.* 5 (2), 1955 (118–23). 17 refs.

Conclusions from a series of tests on plywood are that mechanical tests give a closer estimate of bond strength than wood failure.

4606. SORSA, B. Vanerin liimauslujuuden määrääminen. **[Determining the shear strength of plywood.]** *Pap. ja Puu* 37 (4*a*), 1955 (123–6, 139). 8 refs. [Fi.e.] P.R.

Discusses some factors affecting the results of plywood shear tests. Results are erratic with a glue-line length or a distance between the saw-kerfs of 1 in., because tearing stresses are very high; a shorter glue-line length (e.g. 10 mm., which was used in comparative tests) gives more consistent results. If two test pieces are glued together, the length of glue line no longer has any significant effect on results. Optimum moisture content for determining dry strength is 12–15%, shear strength values dropping rapidly for higher moisture contents.

4607. NISKANEN, E. Liimatuista puurakenteista. **[Glued laminated timber structures.]** *Pap. ja Puu* 37 (3), 1955 (61–70). 16 refs. [Fi.e.] P.R.

A general account, with some reference to research on glued structures at the Wood Technical Laboratory of the State Institute for Technical Research, Helsinki.

4608. **Standard specifications for the design and fabrication of structural glued laminated lumber. Douglas Fir. 1953. West Coast Lumbermen's Association.** Timber Structures, Inc., Oregon [*n.d.*] pp. 12 + 2 photos + 1 tbl. 14 refs. P.R.

4609. **Report of sub-committee on splicing and bending of curved glued laminated members.** National Security Industrial Association Task Committee, United States. 1951. pp. 9 + 3. P.R.

Results are presented and discussed of tests on such members, made from Douglas Fir and White Oak.

832.3. Match Factories

See No. 4464.

833. *Timber in Buildings and Engineering Structures (Manufacture and Use)*

833.1. Building Components and Fittings: General

See also Nos. 4519, 4524, 4559–60, 4607–9.

4610. ROSCOE-HUDSON, A. **Utilization of conifer thinnings in housing.** *Quart. J. For.* 49 (2), 1955 (100–8 + 2 plates).

Gives details of construction, and describes an office recently constructed by the Forestry Commission at Santon Downham from conifer thinnings from the forest of Thetford Chase. [Cf. *For. Abstr.* 16 (pp. 303–4).]

4611. ANDERSON, L. O., and HEYER, O. C. **Wood-frame house construction.** *Agric. Handb. U.S. Dep. Agric.* No. 73, 1955. pp. 235. 63 refs. Price $0·65.

4612. **Timber construction standards.** American Institute of Timber Construction, Washington. 1954. pp. 39. Price $3·00. P.R.

Contains the following standards and classification recommended by the American Institute of Timber Construction: (1) construction and service classification; (2) specifications for the design of structural timber framing; (3) minimum standards for the fabrication of structural timber; (4) minimum standards for erection of fabricated timber; (5) outline specifications for structural timber framing; (6) code of standard practice; (7) reference specifications and codes; and (8) notations and abbreviations.

4613. NISKANEN, E. Vaneri rakenneaineena. **[The structural applications of plywood.]** *Pap. ja Puu* 38 (4*a*), 1955 (113 . . . 122). 18 refs. [Fi.e.] P.R.

The strength properties of plywood are briefly described and some numerical data are given on the tension, compression, bending, and shear strengths of Finnish Birch plywood. The structural application of plywood to ordinary dwelling houses, schools, industrial buildings, plyforms, silos etc., is illustrated by examples. A more detailed account is given of tests on box beams and the causes of their rupture. *Author's summary.*

4614. **'Trofdek'. A further use for 'Aerolite 300' in building structures.** *Bull. Aero-Res., Duxford* No. 145, 1955. pp. 4. P.R.

Describes and illustrates the application of 'Aerolite 300' to 'Trofdek', a trough-shaped product consisting of softwood battens spaced out and held by sloping lengths of plywood to provide structural members for floors, roofs and walls.

4615. Eine kombinierte Leim-Nagel-Konstruktion. Die Trigonit-Gitter-Stegbauweise. **[Combined glued-nailed structure. The Trigonit lattice.]** *Holz-Zbl.* 81 (30/31), 1955 (375–6). [G.] P.R.

The Trigonit-type beam consists of an upper and a lower girder connected by a lattice system of diagonal design. The diagonal elements are joined together by means of glued wedge joints, on to which the girders are nailed laterally. The merits and applications of the structure are described.

4616. CURRY, W. T. **Laminated beams from two species of timber: theory of design.** *Spec. Rep. For. Prod. Res., Lond.* No. 10, 1955. pp. 28 + 2 photos. 9 refs. Price 1*s.* 6*d.*

A theoretical analysis of the stresses in two-species beams was made. Equations developed for calculating the strength of any form of construction from the basic properties of the materials were shown to give accurate results when checked against tests on actual sections [cores of *Abies nobilis*, laminations of *Swartzia leiocalycina* or *Sterculia rhinopetala*]. *From author's summary.*

4617. PETUR, A., and KURUTZ, I. **Design of wooden beams subjected to bending, with regard to the elastic properties of wood.** *Acta Technica Hungarica, Budapest* 7 (3/4), 1953 (257–74). [Hung.?] From *abstr.* in *Appl. Mech. Rev.* 7 (11), 1954 (No. 3557). P.R.

The problem of bending of wooden beams is treated by recognizing the non-linear elastic stress/strain properties and asymmetrical strength properties in tension and compression. A semi-empirical design chart is presented for predicting the failure moment of a beam of solid or flanged section, based on the tensile/compressive strength ratio of the material. An approach of this type is more rational than the conventional modulus-of-rupture and form-factor method; it appears to be easier to apply, and limited experimental data indicate that it is more accurate.

4618. RADCLIFFE, B. M., and KING, E. G. **The flexural behavior of small wood T-beams.** *Bull. Ind. agric. Exp. Sta.* No. 590, 1953. pp. 19. 4 refs. P.R.

Findings are presented of flexure tests of small, clear-wood T-beams of 5 important species, the majority being of Douglas Fir, true Fir, and Western Hemlock. The static flexural properties of T-beams were found to be lower than those for matched rectangular beams. The moment-resisting ability of T-beams was greater than that of rectangular beams of the same height and equivalent area. No shear failures were observed in any of the T-beams tested. Mechanical properties were expressed graphically as functions of the geometric support function (an expression involving relative flange and web thicknesses and total height and width). *From authors' summary.*

4619. PEARSON, R. G. **The secant approximation and the Perry formula. Expressions for eccentrically-loaded struts.** *Repr.* from *Engineering* 178 (4632), 1954. pp. 1. 6 refs. P.R.

4620. SUNLEY, J. G. **The strength of timber struts.** *Spec. Rep. For. Prod. Res., Lond.* No. 9, 1955. pp. 28 + 3 photos. 4 refs. Price 1*s.* 6*d.*

Results of tests on struts of the type used in light constructional work of high-quality Douglas Fir and Sitka Spruce, clear and knotty Scots Pine and imported Baltic Redwood (*Pinus sylvestris*) of commercial quality, are given in graphs and tables. The use of formulae in calculating strengths is discussed.

4621. HABEL, A., and ZACHER, W. **Secondary stresses in wooden trusses.** *Bautechnik, Berlin* 31 (1), 1954 (13–9). [G.] From *abstr.* in *Appl. Mech. Rev.* 7 (11), 1954 (No. 3556). P.R.

Studying 3 examples of nailed or bolted wooden trusses, the authors analyse the influences on stress values of (1) continuity of chords, (2) rigidity of joints of vertical members to chords, and (3) eccentricity of bars with respect to joints. Calculations made in the usual way (assuming pin joints) give dimensions for the different members that need not be modified as a consequence of this more accurate investigation in respect of (1) and (2). In the case of (3), practical rules are given to reinforce the trusses where they appear to be weak according to exact calculation.

4622. STERN, E. G. **How to build nailed trussed rafters.** Industrial Publications, Inc., Chicago. [*n.d.*] pp. 27. (*Repr.* from *Practical Builder, Chicago.*) P.R.

Describes the construction of trussed rafters for spans of 18–36 ft. and pitches from 3/12 to 6/12; the rafters are designed for 35-lb. live and dead roof load and a 10-lb. ceiling load. Deflection is held within 1/360 of the span.

4623. JOHNSON, J. W. **Lateral test on a 12- by 60-foot plywood-sheathed roof diaphragm.** *Rep. Ore. For. Prod. Lab.* No. *T*-11, 1955. pp. 9 + 8 photos + 2 gphs. + 3 tbls. 3 refs. P.R.

A full-scale 12 × 60-ft. roof diaphragm, sheathed with ½-in. × 4 × 8-ft. plywood and with joists at 24-in. centres, was built and tested at the Oregon Laboratory. It was constructed with 2 × 4-in. blocks nailed edgewise between the joists to support the plywood panel edges. The basic nailing pattern was 8d. common wire nails spaced at 6-in. intervals along panel edges. Fifth-point loading was applied to the diaphragm, which was supported on a 60-ft. span. In determining design loads, repetitive loading was used to ascertain any set at various load levels. Chord deflections and other deformation data were obtained. The specimen took a maximum shear load of 1045 lb./linear foot of diaphragm width; failure was caused primarily by nails pulling from the framing and bending as the panels rotated. Repetitive loading to 360 lb./linear ft. caused no significant increase in set or deflection rate. A design shear of 360 lb./linear ft. has been recommended and adopted for this construction. *From author's summary.*

833.4. Special Uses in Agricultural Structures

See also Nos. 4613, 4685.

4624. GROUT, A. R. **Construction of pole-type [farm] buildings.** *Circ. Pa. St. Coll. Agric. Ext. Serv.* No. 437, [1954?]. pp. 14.

4625. Construcción de silos de madera para zonas tropicales. **[The construction of wooden silos**

for tropical zones.] Departamento de Informaciones del Programa Cooperativo de Experimentación Agropecuaria, Lima. 1955. pp. 12. [Span.] P.R.
Practical information on their construction.

833.5. Wood in Bridges, Culverts etc.

4626. Selbo, M. L., and Angell, H. W. **Performance of laminated preservative-treated railroad bridge stringers.** *For. Prod. J.* 5 (1), 1955 (84–8). 1 ref.
Southern Yellow Pine timber was pressure-treated with either creosote or Wolman salts before being glued into stringers with resorcinol glues; the material to be creosoted was conditioned by steaming before pressure treatment. Controls were glued first and then treated. Samples from the stringers were used for dry-shear and delamination tests. Shear strength and % wood failures were satisfactory for the controls and the Wolmanized material. The average strength of samples from 12 creosoted stringers was 1582 lb./sq. in. as against 1835 for Wolmanized material and 1864 for the controls. No direct comparison is possible because no data were obtained on sp. gr., and the material was unmatched. The steam conditioning before creosoting would, however, tend to reduce wood strength. Delamination tests gave generally satisfactory results. Examination of the stringers after 3 and 5 years in service showed them to be in good condition.

834. *Shingles. Cooperage. Packing Containers. (Manufacture and Use)*

See also No. 4584.

4627. Colyer, W. T. **Wooden vats for corrosive liquids.** *Corrosion Technology, London* 1 (10), 1954 (379–81). P.R.
Describes the properties and applications of wood as a material for vat construction. The following species are particularly suitable: Pitchpine, Burma Teak, Peroba de Campos, Siberian Larch, Siberian Redwood, English Oak, Douglas Fir. Air drying is imperative because of the thickness involved.

4628. Nysenko, N. T. **[Composite wood materials for making apparatus for wood-chemical industry.]** *Derev. lesohim. Prom.* 2 (9), 1953 (11–4). [Russ.] From *abstr.* in *Chem. Zbl.* 125 (26), 1954 (5880). [G.] L.S.
A good substitute for Cu in apparatus in contact with acetic acid is a material consisting of alternating layers of Pine veneer 0·3–0·4 mm. thick and sawdust impregnated with formaldehyde resins.

4629. **List of [U.S. Forest Service] publications on box and crate construction and packaging data.** *Rep. U.S. For. Prod. Lab., Madison* No. 791, 1955. pp. 23. P.R.

4630. **Wooden pallets.** *Lumberm.* 82 (4), 1955. (90–4).
A review of the industry, in the U.S.A., including data on materials and equipment, and a glossary of terms used.

835. *Industrial and Domestic (Utility) Woodware. Toys and Models. Sports and Recreational Goods. Musical, Scientific and Mathematical Instruments. Surgical Applications etc.*

See also No. 4452.

4631. Williams, M. A. **Pattern making timbers used in Australia.** *For. Prod. News Lett. C.S.I.R.O. Aust.* No. 204, 1955 (1–2).
Discusses the desirable properties and lists 16 softwoods and 14 hardwoods, of which respectively 7 and 11 are indigenous.

4632. **[Wood for bakehouse cooling and storage trays.]** *Timb. Tr. J.* 212 (4098), 1955 (79).
The T.D.A. recommends Obeche and Afara (already in use), Ramin, Podo, Parana Pine, and Obura, and a number of temperate-zone hardwoods.

4633. **Substitute woods [for baseball bats].** *Rep. Dep. For. S. Afr. 1952/1953*, 1954 (18).
Eucalyptus maculata gives a cheaper bat of suitable weight, shock absorbent and of considerably longer life than imported Ash.

4634. Scheffer, T. C., and Collins, E. J. **A wood-sensing element for tension-type hygrostats used in near-saturation humidities.** *Rep. U.S. For. Prod. Lab., Madison* No. 2026, 1955. pp. 2 + 1 photo + 1 dgm. P.R.
The sensing element consists of a piece of dense Maple sapwood, free of defects, $\frac{1}{32}$ in. thick × $\frac{5}{8}$ in. wide × $2\frac{1}{2}$ in. long; it is cut across the grain from a flat-sawn board in which the growth rings are as straight as possible. Its merits are discussed. [Cf. *For. Abstr.* 8 (No. 549).]

4635. **Substitute woods [for violins].** *Rep. Dep. For. S. Afr. 1952/1953*, 1954 (18).
An instrument of quality far above expectation was manufactured from Yellowwood (*Podocarpus* sp.), for the belly, bass bar and sound post; selected quarter-sawn Cape Beech (*Rapanea melanophleos*), for the back, neck, sides and bridge; Knysna Boxwood (*Gonioma camassi*) for the bow; and Cape Ebony (*Heywoodia lucens*), for the chin rest, finger board, frog pegs and tailpiece.

839.2. *Wood Flour and its Manufacture*

See No. 4788.

839.8. *Industrial Waste Wood, its Processing and Uses*

See also Nos. 4695, 4743, 4774, 4788.

4636. Reineke, L. H. **Briquets from wood waste.** *Rep. U.S. For. Prod. Lab., Madison* No. 1666–13 (rev.) 1955. pp. 7. 4 refs. P.R.
Cf. *For. Abstr.* 9 (No. 2332).

4637. Användning av klenvirke och sågverkavfall. **[Uses of small wood and sawmill waste.]** *Skogen* 42 (7), 1955 (121–5). [Sw.]

Short papers read at the annual meeting of the Svenska Skogsvårdsförening, with discussion: Available amounts of small wood and sawmill waste (*B. Thunell*); The use of small wood and sawmill waste in the pulp industry (*N. Arve*); The use of small wood and sawmill waste in the fibreboard industry (*B. Segring*); and Experience in burning chips (*F. Berg*).

4638. Salomon, R. L'utilisation des combustibles. Foyers. **[Utilization of fuels. Furnaces.]** *Rev. Bois Appl.* 9 (1), 1954 (12–5). [F.]

Illustrated description of industrial furnaces in general, and those burning waste wood and sawdust in particular. One French furnace is dealt with in more detail.

4639. Technische Neuheiten. Eine neue automatische Späne - Holzstaubverbrennungsanlage. **[Technical novelties. A new automatic plant for burning chips and wood dust.]** *Holz.-Zbl.* 81 (40), 1955 (522). [G.]

Illustrated description of a plant in which wood waste is fed into the furnace in the form of an air/chip/dust mixture; a thermostatically controlled valve shuts the duct when the temperature of the fire chamber exceeds 600° C.

4640. Akimova, A. V. **[The cleaning of furs in sawdust.]** *Československ. Kožařství* 3, 1953 (115–9). [Cz.?] From *abstr.* in *Chem. Abstr.* 49 (1), 1955 (7879). L.S.

Beech sawdust is better than Oak, and Spruce is unsuitable. A chemical method of identifying these three kinds of sawdust is given. Cleaning is quicker with dry, fine sawdust.

4641. Forbes, R. H. **Mill waste goes to work.** *B.C. Lumberm.* 39 (3), 1955 (74 . . . 77).

Describes the bacterial digester used by the Organic Pacific Company, Union, Oregon, which is the agent for the patent of the Earp Laboratories, Hampton, N.J., dealing with the conversion of organic wastes, including sawdust, into compost.

4642. Baker, J. R., and Dunn, S. **Sawdust composts in soil improvement. III. Pot cultures and studies with composts from (*a*) outdoor pits, (*b*) wooden bins with high moisture, (*c*) other mixtures.** *Plant and Soil* 6 (2), 1955 (113–28). 8 refs.

[Cf. *For. Abstr.* 14 (Nos. 2758, 2759).] The best plant responses were given by sawdust composts made with green vegetation, hen manure, or both. Other manures and commercial fertilizers were inferior for composting sawdust.

4643. **Field tests indicate sawdust mulches yield larger crops, better soils.** *Lab. Notes Ore. For. Prod. Lab.* No. 18, 1955. pp. 2. 5 refs.

Blueberry plots mulched with Douglas Fir sawdust gave, over a 6-year period, more than double the yield of plots mulched with Oak leafmould, 3 times the yield of plots mulched with straw, and almost 6 times that from clean cultivated plots. All plots received the same water and fertilizers. Increased yield also followed the use of sawdust-mulch with strawberries, but it was found advisable to incorporate the sawdust in the soil, as surface mulching favoured red-stele disease.

84. PRESERVATION AND OTHER TREATMENTS TO IMPROVE THE PROPERTIES OF WOOD. DAMAGE BY BIOLOGICAL AGENCIES AND ITS CONTROL. SEASONING. TIMBERYARD PRACTICE

841. *Wood Preservation*

See also Nos. 4504–5, 4626, 4709–10.

4644. **List of publications on wood preservation.** *Rep. U.S. For. Prod. Lab., Madison* No. 704, 1955. pp. 33. P.R.

Includes publications that give general information and the results of research by the Madison Laboratory since 1915.

4645. Colley, R. H. **Economy in action: postwar trends in the production and consumption of treated wood in the United States; 1945–1953.** Bernuth, Lembcke Co., Inc., New York. 1955. pp. 42.

Consists mainly of a series of 16 tables.

4646. Blew, J. O. **Some experiences of the Forest Service with treated wood.** *Prepr. Amer. Wood Pres. Ass.* 1955. pp. 12. P.R.

Discusses the requirements of the Forest Service with regard to treated wood; presents information on the use of treated wood in two regions and includes service records for treated towers and bridges under contrasting climatic conditions in the Southern and Intermountain regions. *From author's summary.*

4647. Haeren, M. L. van. La protection chimique du bois contre les xylophages et les champignons. **[Chemical protection of wood against insects and fungi.]** *Bull. agric. Congo belge* 46 (1), 1955 (175–82). 5 refs. [F.f.flem.] (Reproduced from *Industrie chimique Belge, Bruxelles* 19 (11), [1954].)

Argues from fundamental principles a logical method for evaluating preservatives, based on the toxic threshold, vapour pressure, volatility, leaching, chemical stability and volume of wood to be effectively treated, using pentachlorophenol, monoplus dichloronaphthalene, and Na arsenate as examples. The curative dose in surface treatments (possible only with substances producing toxic vapours) is generally covered by the factor of safety ($\times$ 2 or $\times$ 3) used in the preventive dose. A good preservative allows the easy penetration of a dose of 2–3 times the toxic threshold to a depth of 5 (oil) or 7 mm. (aqueous). The German standard DIN526.18 is considered to be too low.

4648. Heiks, R. E., Blum, S. E., and Burch, J. E. **The development of a new solvent extraction method for characterizing coal-tar creosotes and petroleum derivatives and its application in wood preservation.** *Prepr. Conv. Brit. Wood Pres. Ass. 1954*, No. 6, 1954. pp. 23. 8 refs. P.R.

The results of infra-red absorption and chromatographic studies of creosote and petroleum oils are outlined, and a new method of investigation, based on the distribution of these oils between *n*-heptane and β,β'-oxydipropionitrile (ODPN), is described in detail. The ODPN-insoluble value (% of substance by weight, insoluble in ODPN) is a very

reliable indicator of the number of aliphatic C atoms in the solute. Infra-red spectra of different whole oils and their ODPN-soluble and ODPN-insoluble fractions are graphed, and the reproducibility of ODPN-insoluble determinations is tabulated. Soil-block tests with Southern Pine sapwood blocks and *Lentinus lepideus* have shown that the ODPN separation divides oils into two fractions, the ODPN-soluble being much more toxic than the other. While the ODPN-soluble fractions have threshold retentions nearly of the same value, regardless of whether the oil is of coal tar or petroleum origin, the quantity of the toxic fractions in the latter is much less than that in the former.

4649. N. V. Houtbereiding Gebrs. van Swaay. Werkwijze voor het tegen bederf vrijwaren van hout. **[Method of preserving wood.]** *Netherlands Patent* No. 75,223, July 15, 1954. pp. 2. [Du.] P.O.

Before the conventional treatment with $HgCl_2$, the wood is treated with an aerosol of DDT or with a solution or dispersion of DDT.

4650. Schmittutz, C. (to Osmose Holzimprägnierung Carl Schmittutz). Holzimprägnierungsmittel und Verfahren zu seiner Herstellung. **[Wood preservatives and methods of manufacturing them.]** *German Patent* No. 907,345, March 25, 1954. pp. 3. [G.] P.O.

Water-soluble preservatives (NaF, dichromate etc.) are mixed with stable water/oil emulsions and kieselguhr. By adding oil or water the product becomes spreadable.

4651. Pauli, O. (to Farbenfabriken Bayer A.G.). Wasserlösliches Imprägniermittel für Holz. **[Water-soluble impregnant for wood.]** *German Patent* No. 898,802, Dec. 3, 1953. pp. 2. [G.] P.O.

The impregnant contains some citric acid or a soluble salt thereof, in addition to H_2CrO_4, H_2AsO_4 (and HF) or their salts, and other preservatives (e.g. dinitrophenol).

4652. Swaay, H. G. J. A. van. Procédé de préparation d'agents de traitement du bois. **[Method of preparing wood preservatives.]** *French Patent* No. 1,025,380, April 14, 1953. pp. 2. [F.] P.O.

The use of a Wolman salt with a modified dichromate and/or dinitrophenol content, so as to obtain a solution of pH 5–6.

4653. Ree, W. van. Het verduurzamen van tusam-planken (*Pinus merkusii* Jungh. et de Vr.) met superwolmanzout (voorlopige mededeling). **[The preservation of boards of *P. merkusii* with super Wolman salt (preliminary report).]** *Rapp. Bosbouwproefsta., Bogor* No. 70, 1955. pp. 9. [Du.]

Boards, 400 × 20 × 2 cm., were treated with a 3% solution by soaking for 7 days or under pressure. Data on moisture content, air-dry density, uptake of preservative, and length of drying are tabulated. Penetration into different zones of the wood is described. It is concluded that air-dry *P. merkusii* planks are very suitable for treatment with salt solution; soaking is adequate, where conditions of service are not too severe. Graveyard tests are in process.

4654. Ree, W. van. Het opnemend vermogen van gelampalen t.o.v. een 3-procentage oplossing van superwolmanzout. **[The uptake by Gelam posts of a 3% solution of super Wolman salt.]** *Rapp. Bosbouwproefsta., Bogor* No. 69, 1954. pp. 9. [Du.]

Posts, 50 cm. long and 70–105 mm. in diam., of Gelam (the variety of *Melaleuca leucadendron* found in the swamp areas of S. Sumatra and Kalimantan and not yielding oil) were treated with 3% solution either by soaking for 7 days or under pressure. Tabulated data are given showing original moisture content, air-dry density, uptake of preservative in litres and kg. salt per cu.m., and length of drying after treatment. Results after 6 months' graveyard tests show that both processes increase resistance to fungi and insects as compared with untreated controls, but prolonged testing is needed to determine their precise value.

4655. Emler, P., Schellung, F., and Schulenburg, W. (to Deutsche Gold- und Silber-Scheideanstalt). Verfahren zum Konservieren von Holz. **[Method of wood preservation.]** *German Patent* No. 898,952, Dec. 7, 1953. pp. 3. [G.] P.O.

Impregnation with $Zn(CNS)_2$, made insoluble by e.g. an addition of anilin.

4656. Voss, W., and Scholz, E. Imprägnieren von Holz. **[Impregnation of wood.]** *German Patent* [*East Germany*] No. 2307, Jan. 12, 1953. [G.] From *abstr.* in *Chem. Zbl.* 125 (42), 1954 (9656). [G.] L.S.

Wood is impregnated with solutions containing lignin-sulphonic acid or water-soluble condensation products of lignin-sulphonic acid with aldehydes or phenols, and amines. The uptake of impregnants is ca. 15–20%, of which only a small fraction is leachable.

4657. Compagnie de Produits Chimiques et Electrométallurgiques Alais, Froges et Camargue, and Progil. Holzkonservierungsmittel. **[Wood preservative.]** *Austrian Patent* No. 176,351, March 15, 1953. pp. 1. [G.] P.O.

An aqueous solution (total solute content 0·1–0·2%), to be applied by the Boucherie method, consisting of alkali salts of polychlorophenols (2-4 Cl atoms), in mixture with alkali phosphates, metaphosphates, polyphosphates or with alkali salts of the triglycolamidic acid or the ethylene-*bis*-aminoacetic acid.

4658. Daimler, K., and Lorenz, V. (to Farbwerke Hoechst A.G.). Verfahren zur Sichtbarmachung von chlorierten Phenolen im Holz. **[Visual detection of chlorinated phenols in wood.]** *German Patent* No. 898,801, Dec. 3, 1953. pp. 2. [G.] P.O.

Chlorinated phenols are combined with naphthols and then used for wood impregnation. A colour reagent sensitive to naphthols can be used to determine the penetration of the impregnant.

4659. Daimler, K. (to Farbwerke Hoechst A.G.). Holzschutzmittel. **[Wood preservatives.]** *German Patent* No. 907,694, March 29, 1954. pp. 2. 8 refs. [G.] P.O.

Pentachlorophenol in chlorination products of mobile aliphatic hydrocarbons, of suitable boiling-point and Cl content.

4660. Dow Chemical Company. **Wood preservative composition and a method of preserving wood.** *Brit. Patent* No. 699,207, Nov. 4, 1953. pp. 3. P.O.

The preservative consists of an aromatic petroleum-oil gel containing $\lt 4\%$ by weight of pentachlorophenol; it is applied as a coat, particularly to timber at about ground level.

4661. **Practical aspects of the occurrence and prevention of sludge in pentachlorophenol-petroleum solutions.** *Technical Newsletter, Chapman Chemical Company, Memphis* No. 13, 1954. pp. 5 + 6 dgms. P.R.

4662. Strahm, F.-É.-M., and Koechlin, É. Perfectionnements à l'utilisation des boues anthracéniques. **[Improvements in the use of anthracenic sludge.]** *French Patent* No. 999,184, Jan. 28, 1952. pp. 1. [F.] P.O.

Crude anthracenic sludge mixed with ethanolamine soap is used as a fungicidal preservative in the form of an aqueous emulsion, with a wetting agent added.

4663. Walker, H. G. (to Pennsylvania Salt Manufacturing Co.). **Wood preservation with dimethyl tetrachlorophthalate.** *U.S. Patent* No. 2,650,893, Sept. 1, 1953. pp. 1. 2 refs. P.O.

For example: a composition for protecting wood against termite attack, containing dimethyl tetrachlorophthalate, an organic solvent for it, and water. The method suggested is immersion.

4664. Furusawa, K. **[Studies on the penetration of 'Karamatsu' (*Larix kaempferi*) by creosote oil.]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 76, 1954 (169–74). 7 refs. [Jap.jap.e.]

The late wood is easier but the early wood is very difficult to impregnate in air-dried timber. The cause of this is obscure but it is apparently influenced by the closure of the bordered pits. Green specimens, treated with alcohol or acetone and dried, can be uniformly impregnated with creosote. On a laboratory scale, the Boulton and vapour-drying processes appear effective but this needs confirmation in large-scale tests.

4665. Ellwood, E. L. **Effects of high pressure impregnation on softwoods.** *For. Prod. News Lett. C.S.I.R.O. Aust.* No. 205, 1955 (2–3).

In pilot tests on 31 Eucalypts and 16 non-Eucalypts, collapse following creosote pressures of 1000 lb./sq. in. at 150° F. occurred only in the low-density softwoods (Spruce and King William Pine). Standard treatments are up to 250 lb./sq. in. The schedule recommended for small round poles of Swedish Spruce is 400 lb., 2½ hr., 150°. For sawn Douglas Fir, the best penetration and retention commensurate with the highest pressure and shortest time without collapse was obtained at 300 lb., 2 hr., 130°. Retention was 11·9 lb./cu. ft. compared with 14·3 for treatment at 150 lb., 5 hr., and 190°, but in the latter there was some collapse. Research proceeds on the treatment of the more impermeable softwoods with higher pressures and shorter times. [Cf. *For. Abstr.* 16 (No. 2333).]

4666. Hudson, M. S.; Stasse, H. L.; Wells, J. H., and Bordenca, C. **A study of creosote treatment of seasoned and green Southern Pine poles. I. Impregnation and distribution of creosote in Southern Pine poles. II. Composition of creosote as distributed in Southern Pine poles. III. Bleeding of poles.** *Prepr. Amer. Wood Pres. Ass.* 1955. pp. 35. 12 refs. P.R.

In the first part of the study, seasoned and green Southern Pine poles impregnated with 20 or 40% creosote were subjected to cleaning with steam or organic vapours. Tables and curves give the effect of these treatments on the distribution and composition of the creosote and on the initial bleeding tendency. Distillation tests were carried out, in the second part of the study, with creosote recovered from various zones of impregnated poles; it was found that the losses during the vacuum period and during steaming or vapour-cleaning operations are small. Losses of low-boiling distillate from the creosote in inner zones of such poles are negligible. To determine, in the third part of the study, the effect of after-steaming and of vapour cleaning on the bleeding tendency of creosoted air-seasoned or green poles, the poles treated in the same way as in the first two parts of the study were subjected to field and laboratory tests preliminary results of which are presented; no conclusions can be drawn as yet on the effect of after-cleaning treatments on the bleeding tendency. *From authors' summaries.*

4667. **Important factors contributing to the bleeding of pentachlorophenol-petroleum solution from pressure-treated wood, and methods available to the treating plant operator which will reduce the amount of bleeding.** *Technical Newsletter, Chapman Chemical Company, Memphis, Tenn.* No. 14, 1955. pp. 5. P.R.

The main factors contributing to bleeding are: air in the interior of the wood, distillation range and viscosity of the petroleum solvent, and the colour of the treated wood. The most widely used methods of conditioning wood to reduce the amount of bleeding are discussed, viz.: steaming before treatment, expansion bath after treatment, and steaming after treatment.

4668. Shibamoto, T., and Inoue, Y. **[Studies on preservative treatments of stem of Bamboo (*Phyllostachys edulis*).]** *Misc. Inform. Tokyo Univ. For.* No. 10, 1955 (23–30). 4 refs. [Jap.jap.e.]

Tabulates with English captions: inhibiting concentrations of 7 fungicides against *Penicillium* and *Aspergillus* (Na pentachlorophenate being best); the invasion by these moulds of holes made in test-pieces after impregnation (3 preservatives); the growth of *Penicillium* on Bamboo after treatment (39 chemicals or formulations); the loss of weight after attack by *Irpex lacteus* (26); the same for 14 chemicals or formulations applied by the steeping, hot steeping, hot-and-cold, and vacuum processes. Penetration by Na pentachlorophenate was less than by NaF or Na dinitrophenol, but improved with the hot-and-cold process. Penetration is better in summer-cut Bamboo. Dinitrophenol and dinitrocresol were more effective against *Irpex lacteus* and *Penicillium* on Bamboo, but some of the substances

strongly poisonous to wood rots were less effective on moulds.

4669. KRIEG, W. (to Rütgerswerke-A.G.). Verfahren zum Imprägnieren von Buchenholz. **[Method of impregnating Beech wood.]** *German Patent* No. 898,803, Dec. 3, 1953. pp. 2. [G.] P.O.

Green Beech wood is first treated with oily impregnants (coal-tar oil) under pressure, and then with the main preservative for several hours at ca. 100° C. without pressure.

4670. AMEMIYA, S. **[Preservation of wood by the diffusion process. (II) The penetrating test of a few preservatives on the sapwood of Beech (*Fagus crenata*) with various moisture contents and on the false heartwood of Beech.]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 77, 1955 (165–70). 2 refs. [Jap.jap.e.]

Graphs the end, radial, and tangential surface penetrations over 1–3 weeks, in small blocks of sapwood and false heartwood of initial moisture content of 70, 50 or 30, and 50–75% respectively, when treated with Osmo-salt, Osmo-plastic and Malenit. For 20-mm. penetration, both sapwood and false heartwood should have a moisture content of $> 50\%$. [Cf. *For. Abstr.* 16 (No. 1085).]

4671. SHIBAMOTO, T., and SHOJI, R. **[Studies on the head pressure process (so-called Boucherie process) for wood pole preservation by water-borne preservatives. (1) On the sodium pentachlorophenolate.]** *Misc. Inform. Tokyo Univ. For.* No. 10, 1955 (31–8). 3 refs. [Jap.jap.e.]

With Na pentachlorophenate, variations in pH between 7·5 and 9 are immaterial. The higher concentrations penetrate more rapidly. Penetration times (T,t) are related to lengths of poles (L,l) and heads of pressure in m. (H,h) as follows:—$L^{2\cdot3}t = l^{2\cdot3}T$ and $HT = ht$. Recommendations for Na pentachlorophenate are: strength 1%; pH 7·5–9; volume 600–900 litres/cu.m. wood; with $H = L$, $T = L \times 1{\cdot}5$ days.

4672. SHIBAMOTO, T., and SHOJI, R. **[Studies on the head pressure process (so-called Boucherie process) for wood pole preservation by water-borne preservatives. (2) On the F.D. group preservative.]** *Misc. Inform. Tokyo Univ. For.* No. 10, 1955 (39–47). 4 refs. [Jap.jap.e.]

Penetration by the F.D. solution (81·2% NaF and 9·9% Na dinitrocresol) is very rapid. The recommended solution is 1% strength; pH 7; 600–900 litres/cu.m. wood. Where height of head of pressure is the same as length of pole, allow $L \times 0{\cdot}5$–$1{\cdot}0$ days' treatment where L = length of pole in metres. Fungal inoculation data are included.

4673. GEWECKE, H. (to Atlasmaste K.-G. Dr.-Ing. Hermann Gewecke). Verfahren zum Imprägnieren von Holz zum Schutz gegen Fäulnis und Insektenzerstörung. **[Method of impregnating wood to protect it against rot and insect damage.]** *German Patent* No. 898,800, Dec. 3, 1953. pp. 3. [G.] P.O.

A modification of the Boucherie method. Roundwood, possibly green, is stacked in pyramids and sprayed with impregnants (with or without wetting agents), a vacuum being applied to both ends of each log.

4674. CARR, D. R. **Diffusion impregnation of timber by the momentary immersion process.** *N.Z. J. Sci. Tech.* 36*B* (3), 1955 (351–62). 4 refs. P.R.

Tests with this process on green Tawa (*Beilschmiedia tawa*), using a 30% weight/volume boron solution expressed as equivalent H_3BO_3, followed by block stacking, are described. The tests were designed to examine the effects of surface conditions of boards on solution uptake and subsequent distribution of B in the wood. The effects of partial air-drying and of surface wetting were also examined and the stability of the treating solution over 3 weeks' commercial operations recorded. The highest core retentions were obtained in rough-sawn (circular sawmill) boards treated immediately after sawing. Core retentions obtained in freshly sawn boards that were dressed immediately and then diffusion-impregnated, conformed substantially with the requirements generally specified in New Zealand for such treatments. Equivalent core retentions were obtained in freshly cut rough-sawn boards that were soaked in water immediately before diffusion treatment. Core retentions obtained in partially air-dried boards were unsatisfactory. *From author's summary.*

4675. ROBERTS, E. **Mine timber preservation by collar method. Progress report 1.** *Report of Investigations, U.S. Bureau of Mines, Washington, D.C.* No. 4980, 1953. pp. 14 + 19 photos. 6 refs. P.O.

Reports on an experiment made in 1951 to introduce preservatives into growing wood. Twenty-eight trees were treated by the collar method, a complete record being kept of each individual tree and of each piece of timber cut from it. These were placed in a coal mine, and their tendency to decay is compared with that of controls. Results have been encouraging. Some comparative costs are given for untreated timber, timber treated by conventional pressure methods, and timber treated by the collar method. The chemical used was chromated $ZnCl_2$.

4676. DÖLGER, F. W. Neue Erkenntnisse und Möglichkeiten für das Impfverfahren. **[Further advances and possibilities of the injection method.]** *Holz Roh- u. Werkstoff* 12 (10), 1954 (382–5). [G.g.] P.R.

Describes a new hand-operated injection apparatus and a high-output (multiple) injection machine, as well as a new injection 'needle'. The process is discussed from both technological and economic aspects.

4677. ANDREWS, J. W., BUCO, S. N., and O'BRIEN, P. **Distribution and composition of creosote in a pole that has been in service for twenty-three years.** *Prepr. Amer. Wood Pres. Ass.* 1955. pp. 7. P.R.

The distribution was determined by reducing sections of the pole to shavings, washing the shavings first with toluene and then with pyridine, and finally concentrating the extracts by distillation. The average retention in the pole, after 23 years, was calculated to be 6·6 lb./cu. ft. From the distribution data thus obtained, together with data of physical and chemical analysis, it was concluded that some

creosote had been lost above the ground-line by gravity, movement, evaporation and water leaching. Other changes, resulting from chemical reactions, are likely also to have occurred above the ground-line. Below the ground-line, the creosote extracts had many of the properties of the original creosote. The high concentration of creosote just below the ground-line is believed to have been the most important single factor protecting the pole against fungi and termites. *From authors' summary.*

4678. HINES, E., JACOBI, L. J., and PRETTI-PAVLETTA, W. H. **Distribution of pentachlorophenol in pressure and non-pressure treated Douglas Fir crossarms.** *For. Prod. J.* 5 (1), 1955 (88–91).

Six randomly selected arms given pressure treatment (p.t.) and 6 given non-pressure treatment (n.p.t.) were sawn into sections, examined, and analysed for their pentachlorophenol content. The n.p.t. arms had relatively lower retentions adjacent to the pin and bolt holes and in the centres of cross-sections farthest from pin or bolt holes, higher retentions in the incised surfaces, and retentions similar to the p.t. arms at the ends. The distribution in the different sections is illustrated by photographs. The most significant difference between the two sets of arms was probably in the variation in pentachlorophenal retentions in similar sections, this variation in n.p.t. arms being twice that in p.t. arms.

4679. CONWAY, E. M., and SCHNELL, R. L. **The hot water bath: its use in the treatment of Pine posts.** *Tech. Note Tenn. Vall. Auth.* No. 19, 1953. pp. 8.

Describes the testing of heating schedules on Shortleaf and Virginia Pine posts.

4680. WALTERS, C. S., ZUCKERMAN, B. M., and MEEK, W. L. **The effect of Oak wilt on the cold-soak treatability of Oak fence posts.** *J. For.* 53 (5), 1955 (356–8). 6 refs.

Black and Red Oak posts cut from (*a*) wilt-killed and (*b*) sound trees were air-seasoned and soaked for 48 hours in a fuel-oil/pentachlorophenol solution. Absorption in the (*a*) and (*b*) posts averaged 2·8 and 4·1 lb./cu. ft., and sapwood penetration 91 and 70% respectively. Both absorption and penetration varied less in the sound posts. Wilt-induced tyloses in the sapwood (not normally present in the Red Oaks) appear to inhibit absorption. For affected timber the soak should be 72 hours.

4681. BLEW, J. O. **Comparison of wood preservatives in stake tests (1955 progress report).** *Rep. U.S. For. Prod. Lab., Madison* No. 1761, 1955. pp. 7 + 1 photo + 30 tbls. 3 refs. P.R.

Cf. *For. Abstr.* 16 (No. 2351).

4682. BLEW, J. O., and KULP, J. W. **Service records on treated and untreated fence posts.** *Rep. U.S. For. Prod. Lab., Madison* No. 2005, 1954. pp. 11 + 2 tbls. 25 refs. P.R.

A progress report on service tests. The earliest installations were started in 1908, new tests following in succeeding years. The service records cover a wide variety of post species, 11 methods of treatment, and 67 different preservatives or preservative combinations. Actual or estimated life figures are shown for test installations where 10% or more of the posts had failed at the time of the last inspection. *From authors' summary.*

4683. BLEW, J. O., and KULP, J. W. **Comparison of wood preservatives in Mississippi post study (1955 progress report).** *Rep. U.S. For. Prod. Lab., Madison* No. 1757, 1955. pp. 13 + 2 tbls. 3 refs. P.R.

[Cf. *For. Abstr.* 12 (No. 1391).] Experimental untreated Southern Yellow Pine posts installed from 1936 to 1938 at the Harrison Experimental Forest, Saucier, Miss., had an average life of 3·3 years. Untreated Longleaf Pine posts installed in 1949 had one of 2·3 years, while those treated with a No. 2 fuel oil and with Wyoming residual petroleum oil have an estimated average life of 5 and 6 years respectively. Southern Yellow Pine posts treated with β-naphthol in oil, borax/H_3BO_3, a crankcase oil, $Na_2Cr_2O_7$, and Osmoplastic are estimated to have an average life of 12–18 years, and those treated with any of 19 other chemical wood preservatives should last still longer. *From authors' summary.*

4684. JACKSON, W. F. **Durability of Keruing [*Dipterocarpus* spp.] sleepers in the Malayan railways.** *Malay. Forester* 18 (2), 1955 (91–2).

A service test of 432 unidentified Keruing sleepers, probably a mixture of species, was laid down to test the efficacy of mixtures of creosote and diesel fuel, (*a*) 75/25, (*b*) 50/50, and (*c*) 25/75%, as a preservative. After 19 years' service, (*c*) appeared to be almost as effective as (*a*) (23 and 18% failure respectively); but when all sleepers were taken up 6 months later, 71% of (*a*) were still sound, compared with 22% and 23% of (*b*) and (*c*). Further tests are being made.

4685. **Preserving lumber [in greenhouses].** *Amer. Nurserym.* 101 (8), 1955 (56–7).

A number of paints and other commercial compounds were tested on 4-in. wooden pot labels, stuck into a tray of damp topsoil and kept in a greenhouse for 18 months. The tray was watered constantly, as though containing plants. The following liquids were used, singly or in combination: (1) liquid copper compound (a wood and canvas preservative), (2) high-quality white house-paints containing lead, (3) ditto, green paint without lead, (4) synthetic all-purpose enamel, (5) clear liquid synthetic-resin filler (a primer), (6) green shingle stain with an oil base, (7) boiled linseed oil. After 18 months most of the test labels and all the controls were completely decayed from the soil line down. All labels treated with (6) or with (7) alone or in combination with other compounds were completely rotted, as were all treated only with (1), (2), (3), or (4). Those primed with (1) and then painted with (3) or (4) were just beginning to rot. Three labels primed with (1) and then painted with (2) showed no sign of deterioration. It is suggested that if resistant species of lumber are used and treated with a copper priming followed by good white-lead paint, maximum service will be obtained in greenhouse conditions.

842. *Treatments to Improve the Resistance of Wood to Physical and Chemical Agencies other than Fire*

See also No. 4710.

4686. EVERS, H. (to Humboldt-Universität Berlin, Institut für chemische Technologie). Veredelung von Holz. **[Improvement of wood.]** *East German Patent* No. 1954, Oct. 4, 1952. [G.] From *abstr.* in *Chem. Zbl.* 125 (35), 1954 (8012–3). [G.] L.S.

Low polymers of hemicellulose, and part of the lignin, are removed from veneer by alkalis and Na_2S, $Ca(HSO_3)_2$, $NaClO_2$ or mixtures of these; the veneer is then subjected to parchment treatment (with H_2SO_4 or $ZnCl_2$), or acetylated or nitrated, with or without addition of synthetic resins or glues. The product can also be compressed and dried.

4687. VOSS, W., and SCHOLZ, E. Imprägnieren von Holz. **[Impregnation of wood.]** *German Patent* (*East Germany*) No. 1978, Nov. 26, 1953. [G.] From *abstr.* in *Chem. Zbl.* 125 (30), 1954 (6860). [G.] L.S.

Wood is impregnated with sulphite waste liquor or with aqueous solutions of lignin substances isolated from sulphite liquor or with products of their transformation, together with formaldehyde and substances such as phenol; these can give condensation products with the lignin contained in the liquor, and with other substances, such as amines, amides of acids, or phenols, which give condensation products with formaldehyde.

4688. PIENING, W. Verfahren zur Imprägnierung von Holz, insbesonders von Buchenholz. **[Method of impregnating wood, in particular Beech.]** *German Patent* No. 824,853, Dec. 13, 1951. pp. 2. [G.] P.O.

Beech wood is impregnated with paraffin-wax containing by-products of the oil industry, of suitable consistency.

4689. NOWAK, A. Verfahren zur gleichmässigen Imprägnierung von Holz. **[Method for uniform impregnation of wood.]** *Austrian Patent* No. 174,732, April 25, 1953. pp. 2. [G.] P.O.

To impregnate wood with small quantities of hydrophobic organic substances (e.g. pitch, paraffin wax, resins), it is placed in a solution of the substance in an organic solvent (more volatile than water and immiscible with it) and heated to a temperature ca. 20° C. higher than the boiling-point of the solvent, until the wood has been heated throughout to this temperature.

4690. SVIT, NARODNI PODNIK. Verfahren zur Herstellung von volumbeständigem, gegen hohe Temperaturen widerstandsfähigem Holz. **[Method of producing wood with dimensional stability and resistance to high temperatures.]** *Swiss Patent* No. 266,172, April 17, 1950. pp. 2. [G.] P.O.

Wood is impregnated with an aqueous solution of a phenol alcohol (obtained by condensation of formaldehyde with phenol), and cured by heating.

4691. NYSENKO, N. T. **[Plasticized wood with improved properties.]** *Derev. lesohim. Prom.* 3 (4), 1954 (12–4). [Russ.] From *abstr.* in *Holzforschung, Berlin* 9 (3), 1955 (94). [G.] P.R.

The properties of plasticized wood of density ca. 1·15 g./c.c. can be improved if the pressing is preceded by impregnation with synthetic resins or with 'potato syrup'. Materials of ca. 1·3 and 1·4 g./c.c. are subjected to gradually increasing pressures as temperature increases. A higher proportion of water-soluble extractives (4–6%) brings about a better [dimensional] stability of the compressed articles without any reduction of mechanical strength. Birch is the most suitable wood for heat treatment, but plasticized Beech is more resistant to water than other woods.

4692. APOSTOL, A. V. **[Equilibrium moisture content in compressed wood.]** *Derev. lesohim. Prom.* 2 (8), 1953 (16–7). [Russ.] From *abstr.* in *Chem. Zbl.* 125 (28), 1954 (6377–8). [G.] L.S.

The equilibrium moisture content (m.c.) of compressed Pine wood is 1–2% less than that of natural wood under normal conditions (moderate air humidity), and 5–7% less at high values of relative air humidity. For natural wood the fibre-saturation m.c. is 30·5%; for compressed wood (compression degree 55·8%) it is 24·8% at 100° and 23·4% at 140° C.

843. *Fireproofing and Fire Resistance*

4693. WOODSTOCK, W. H. (to Victor Chemical Works). **Reaction products of olefin oxides and P_2O_5 or P_2S_5 and the method of forming the same.** *U.S. Patent* No. 2,568,784, Sept. 27, 1951. pp. 3. P.O.

The reaction is carried out in a non-aqueous medium at 60–70° C. at low pressures without catalysts. The obtained monomers are used for impregnating (wood, paper), and after heating, fireproof products are obtained.

844. *Attack by Plant Organisms*

See also No. 4760.

844.1. Sap-staining and Mould Fungi

See also Nos. 4668, 4698.

4694. **Sap-stain in timber: its cause, recognition and prevention.** *Leafl. For. Prod. Res., Lond.* No. 12 (rev.) 1955. pp. 6.

Causes and type of stain, conditions favouring development of stain and mould, preventive and control measures.

4695. RICHARDSON, J. H., GUIDICE, V. J. DEL, and WIESMAN, C. K. **Hazards of spores in floor coverings—sawdust.** *Applied Microbiology, Baltimore* 2 (4), 1954 (177–82). L.S.

A report on experiments to control mould fungi in sawdust. Three chemicals were tested for their fungicidal properties: (1) Milmer I, a powder form of Cu 8-quinolinate, (2) a solubilized Cu 8-quinolinate, and (3) dimethyldodecylamine. At a concentration of 0·14%, (1) was fungistatic, and above this concentration was fungicidal; it produced no detectable odour. (2) solubilized under the trademark Cunilate was fungicidal on sawdust, in all forms tried, and in a variety of solvents, at concentrations $\geqslant$ 0·07%. Cunilate in isopropanol,

mineral oil, xylene and mineral spirits had an objectionable odour, but the emulsified form of Cunilate had no detectable odour. (3) was fungistatic at a concentration of 2·8%. *From authors' summary.*

844.2. Wood-destroying Fungi

See also Nos. 3734, 4221–33, 4262, 4529, 4537, 4584, 4668, 4730.

4696. AARON, J. R., and WILSON, K. **Soft rotting fungi in timber.** *Wood* 20 (5), 1955 (186–9). 5 refs.

Illustrates with photomicrographs the usefulness of the polarizing microscope for the early detection of such organisms as *Chaetomium globosum* and *Ceriosporopsis halima* attacking wood in water towers, piles in sea-water, or imperfectly impregnated timber. Cavities produced by these organisms in the cellulose framework show up as dark areas. [Cf. *For. Abstr.* 16 (Nos. 1129, 2375–6).]

4697. MATTERS, C. N. **Project P.11: The characteristics of Australian decay and stain fungi. Sub-project P.11–12: The identification of Basidiomycete fungi in culture. Progress report No. 5. Morphological characters of *Trametes cinnabarina* (Jacq.) Fr., *Polyporus cinnabarinus* (Jacq.) Fr., and *Polystictus sanguineus* (Linn.) Mey.** Division of Forest Products, C.S.I.R.O., Melbourne. 1955. pp. 22 + 4 photos + 5 dgms. 6 refs. P.R.

Cf. *For. Abstr.* 15 (No. 2991).

4698. AOSHIMA, K., and HAYASHI, Y. **[Durability of brown and blue-stained Beech wood.]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 76, 1954 (21–6). 7 refs. [Jap.e.]

Small sapwood blocks of *Fagus crenata* were inoculated with stain fungi, using 2 strains each of *Endoconidiophora bunae* and *Ceratostomella piceae*. After staining, these fungi were killed and the blocks re-inoculated with (1) *Armillaria japonica*, (2) *Tyromyces* [*Polyporus*] *pubescens*, (3) *Coriolus* [*Polystictus*] *hirsutus*, (4) *C.* [*P.*] *versicolor*, (5) *C. consers*, (6) *Lenzites betulina*, (7) *Trametes cinnabarina*, (8) *Trachyderma* [*Fomes*] *tsunodae* and (9) *Hericium* sp., the commonest and most important fungi of the Beech woods of Japan. After 4 months' incubation, the % loss in weight of the blocks was determined. Stained blocks were significantly more resistant than sound ones to species (1) and (7), and significantly less resistant to (5). For the other species of wood-rotting fungi there was no significant difference in resistance. The difference between the durability of stained and sound Beech is not great, and varies with the species or even the strain of stain fungi as well as the species of rot.

4699. NAGAI, Y., AOSHIMA, K., and HAYASHI, Y. **[Laboratory test on the durability of Beech wood felled at different seasons.]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 77, 1955 (21–3). 2 refs. [Jap.jap.e.]

Sapwood blocks taken from *Fagus crenata*, ca. 40 cm. d.b.h., of the same stand, each month of the year, and placed on a sterile medium of sawdust and rice bran were inoculated from agar culture with *Coriolus*[*Polystictus*] *hirsutus*, *Daedaleopsis tricolor*, *Polyporellus* [*Polyporus*] *brumalis*, *Armillaria mucida* and *Lenzites betulina*, and the % loss in weight after 4 months (3 for the last) measured. No significant relation between felling season and resistance to these wood-rotting fungi was found.

4700. MOSES, C. S. **Laboratory decay test of some commercial species of Mahogany.** *For. Prod. J.* 5 (2), 1955 (149–52). 14 refs.

Laboratory tests were made by the soil-block method on 81 boards of true Mahogany (*Swietenia mahagoni* and *S. macrophylla*), African Mahogany (*Khaya* spp.) and 'Philippine Mahogany' (*Shorea* spp., *Parashorea* spp. and *Dipterocarpus* spp.). The fungi used were *Polystictus versicolor*, *Poria monticola* and *Lenzites trabea*. The general level of resistance to decay was highest in true Mahogany and *Shorea guiso* (represented by only one board source) which were resistant or very resistant. *Khaya* spp., *Shorea palosapis*, *S. negrosensis* and *S.* sp. (*polysperma?*) were moderately resistant to resistant. *Shorea* sp. (*eximia?*), *Parashorea* spp. and *Dipterocarpus* spp. were slightly to moderately resistant. There was considerable variation in resistance within species, especially for African Mahogany, blocks from different boards ranging from very resistant to non-resistant. Blocks subjected to laboratory weathering all showed reduced resistance to decay, but the relative order of species resistance was unchanged. Tests on absorption of water during 24 and 72 hours' soaking showed little difference between the species except for *S. guiso*, which showed very low absorption. Absorption by African Mahogany tended to be rather higher than the other species. Blocks of all species showed little relationship between water absorption and susceptibility to decay, but a positive correlation was found within both *Khaya* sp. and *Swietenia macrophylla*.

4701. WOOD, L. W. **Properties of white-pocket Douglas-Fir lumber.** *Rep. U.S. For. Prod. Lab., Madison* No. 2017, 1955. pp. 15 + 6 photos + 4 dgms. + 8 gphs. + 9 tbls. 8 refs. P.R.

A laboratory method for estimating the amount of white pocket rot has been developed. For material included in the light white-pocket group, the strength properties were reduced by ca. $\frac{1}{3}$, stiffness ca. $\frac{1}{4}$, and shock resistance $\frac{1}{2}$–$\frac{2}{3}$. With larger amounts of white pocket, reductions were greater. While the reduction of strength was greater than would be expected from the reduction in density, the nail-holding power decreased nearly in proportion to density. The rate of drying increased with the amount of white pocket. *From author's summary.*

4702. HWANG, S.-W. **Compatibility and variability in *Merulius americanus*.** *Mycologia* 47 (3), 1955 (317–28). 9 refs. P.R.

Describes variants occurring naturally in laboratory cultures.

4703. BÄRLUND, U. Laboratorieförsök beträffande rotsvamparnas inbördes konkurrensförmåga. **[Laboratory experiments on competition between rot fungi.]** *Karstenia, Helsinki* No. 1, 1950 (60–72). 11 refs. [Sw.e.] O.B.D.

Nine wood-rotting fungi were used in the test. Results showing the ability of a second fungus to compete with one established on a block of wood for 1½–2 months are tabulated. Tables and illustrations have English legends.

4704. JENNISON, M. W., NEWCOMB, M. D., and HENDERSON, R. **Physiology of the wood-rotting basidiomycetes. I. Growth and nutrition in submerged culture in synthetic media.** *Mycologia* 47 (3), 1955 (273–304). 37 refs. P.R.

Presents the results of a quantitative comparative study of the growth and nutrition (particularly the utilization of known N compounds) of 42 species of wood-destroying Basidiomycetes. The maximum amount of growth for most forms was attained in ca. 2 weeks. The vitamin requirements and differences in the utilization of single amino acids are given for each.

4705. WALTER, G. R., JR. **Organic acid production by some wood-rotting basidiomycetes.** *Abstr. of thesis*, in *Dissert. Abstr.* 15 (3), 1955 (321). [Syracuse University.] O.R.S.

Studies on the amount of oxalate produced when *Polyporus palustris* was grown on a chemically defined medium, and the organic acids produced by 20 wood-rotting fungi (including *P. palustris*) grown in 1% malt extract.

4706. HIGA, H. H. **Partial purification of cellulose produced by the wood-rotting basidiomycete, *Polyporus palustris*.** *Abstr. of thesis*, in *Dissert. Abstr.* 15 (2), 1955 (189–90). [Syracuse University.] O.R.S.

4707. MOSES, C. S. **Condensation and decay prevention under basementless houses.** *Rep. U.S. For. Prod. Lab., Madison* No. 2010, 1954. pp. 8 + 4 dgms. + 1 tbl. 4 refs. P.R.

Observations and measurements support the hypothesis that sufficient moisture to sustain growth of decay fungi in the end and header joists of basementless houses may arise solely from condensation of water vapour coming from damp soil. The condensation occurs when the wood temperature is below the dewpoint. In field tests, this condensation was prevented by the use of a soil cover. *From author's summary.*

845. *Attack by Animals*

845.1. Marine Borers

4708. RANCUREL, P. Les tarets en Côte d'Ivoire. **[Teredo on the Ivory Coast.]** *C.R. Conf. int. Afr. Ouest, Abidjan 1953*, [1954] (58). [F.]

Summary of paper. The species known on the coast have increased from 2 in 1952 to 14. The saltwater tolerances of two species of *Teredo* and one *Bankia* are given. Radiographic studies were made of the rate of growth of *Teredo* and of the damage to male *Borassus*, Teak and Azobe [*Lophira alata*], all reputedly very resistant but all destroyed in 3 months while others were scarcely attacked. In the same period *Dialium fleuryi* remained immune.

4709. CARR, D. R. **Marine borers in timber structures.** *Repr.* from *N.Z. Engineering, Wellington* 8 (11), 1953 (389–98).

Gives an account of the damage caused by marine borers in New Zealand and data on natural durability of timbers used in marine structures, and describes current tests with the most promising preservatives.

4710. EDMONDSON, C. H. **Response of marine borers to chemically treated woods and other products.** *Occasional Papers, Bernice P. Bishop Museum, Honolulu* 21 (7), 1953 (87–133). From *abstr.* in *Prev. Deterior. Abstr.* 12 (6), 1954 (*Wood* 42). D.S.I.R.

Presents results of tests on a great variety of preservative-treated and modified woods exposed to the action of crustacean and mollusc marine borers. Some processed and improved woods resisted borer attack for several years. Creosoted wood and Asidbar (containing over 50% of a special acid-resistant bituminous compound) resisted Teredo borers for indefinite periods, but did not inhibit Limnoria; the effect of DDT was converse. Results of tests with different resins, metal bands, nailing (studding), anti-fouling paints etc., are also given.

845.2. Terrestrial Borers

4711. **The common furniture beetle.** *Leafl. For. Prod. Res., Lond.* No. 8 (rev.) 1955. pp. 8. 10 refs.

Anobium punctatum: life history, timbers attacked and damage caused, remedial treatments and preventive measures.

4712. DÜRR, H. J. R. **The European house borer *Hylotrupes bajulus* (L.) (Coleoptera: Cerambycidae) and its control in the Western Cape Province.** *Bull. Dep. Agric. S. Afr.* No. 337, 1954. pp. 78. P.R.

4713. GEYER, J. W., and MATTHEE, J. J. **Damage of timber structures by carpenter bees.** *Fmg. S. Afr.* 30 (347), 1955 (45–8). 1 ref. E.M.B.

Notes on the life history of *Xylocopa caffra* var. *mossambica* and the damage it causes. Nest galleries may be found in structural softwood, especially under tiles or thatch. The bees are seldom numerous enough to endanger buildings, but it is advisable to check the damage by covering nest entrances with thin sheets of gauze, or by spraying the galleries with a poison, such as DDT.

4714. BECKER, W. B. **Tests with BHC emulsion sprays to keep boring insects out of Pine logs in Massachusetts.** *J. econ. Ent.* 48 (2), 1955 (163–7). 18 refs.

Cordwood of Red and White Pine (living trees, winter-felled) was almost completely protected when individual logs were sprayed with an emulsion, diluted in water, of BHC or lindane containing 0·2% of the γ isomer; at 0·4% protection was complete. Spraying stacked cordwood with the latter concentration at 2 gal./½ cord gave excellent protection and did not injure living conifer or hardwood plants in the dormant season, but concentrations of only 0·1% damaged the foliage of actively growing hardwoods. Counts of galleries in the wood (cerambycids and ambrosia beetles) and in the bark (weevils and scolytids), a list of borer species, and costs are presented.

845.3. Termites

See also Nos. 3758–9, 4188, 4663.

4715. HARRIS, W. V. **The prevention of termite damage to buildings.** *Colonial Building Notes, Department of Scientific and Industrial Research, London* No. 26, 1955 (1–6). 6 refs. P.R.

Discusses site clearance, barriers ('ant guards'), impregnation of timber, and termite-resistant timbers.

4716. YOUNG, T. R., JR. **Inexpensive heat-exchanger for methyl bromide dry-wood termite fumigations.** *Pest Control* 23 (3), 1955 (45–6). P.R.

Illustrated description of a low-cost heat-exchanger which prevents the 'frosting' of the spraying hose due to the freezing of the expanding gas.

847. *Drying* (*Seasoning*)

See also Nos. 4592, 4603–4.

4717. **List of publications on the seasoning of wood.** *Rep. U.S. For. Prod. Lab., Madison* No. 446, 1954. pp. 16. P.R.

Lists Madison publications and those contributed by members of the Madison staff to American periodicals since 1930.

4718. HUFFMAN, J. B. **Distribution of resinous extractives in Loblolly Pine lumber after seasoning.** *For. Prod. J.* 5 (2), 1955 (135–8). 17 refs.

Amounts of residual extractives, primarily non-volatile, from various layers of green, air-, kiln- or vapour-dried sapwood lumber of known and matched origin, and from paired kiln- and vapour-dried knots were measured. In kiln-dried sapwood boards, resin content decreased from the surface inwards, being high ($> 3{\cdot}5\%$ based on oven-dry weight of wood) at the surface and the curve crossing that of the green boards ($2{\cdot}0\%$) at a depth of 0·10 in. In vapour-dried boards resin content was low in the outer layers ($< 0{\cdot}5\%$ at the surface) and increased towards the centre, the curve crossing that of the air-dried material (just over $1{\cdot}5\%$) at a depth of about 0·10 in. and approaching that of the green boards at 0·30 in. The curve for the air-dried material showed little variation in the different layers but was rather below that for the green boards (a little $> 1{\cdot}5$ and $2{\cdot}0\%$ respectively). In kiln-dried knots the resin content decreased rapidly in the outer layers and increased again more slowly to the centre, while the pattern for vapour-dried knots was similar to that for boards apart from the higher amount of resin in the knots.

4719. MATHEWSON, J. S. **News and views of this kiln drying business. What is the cost of steam lost through leaks?** *Rep. U.S. For. Prod. Lab., Madison* No. 1769–16, 1955. pp. 2. P.R.

An example of the use of Napier's approximate formula for estimating the weight of steam lost through holes of different sizes.

4720. BREITENMOSER, C. Verfahren und Einrichtung zum Trocknen von Holz. [**Method and apparatus for drying wood.**] *Swiss Patent* No. 289,448, July 1, 1953. pp. 4 + 1 dgm. [G.] P.O.

Air in a completely closed kiln is circulated so that it enters the stack at 80–100° C. and leaves it at 60–80°. The heating and cooling is effected by means of radiators with hot and cold water.

4721. MCMILLEN, J. M. **Drying stresses in Red Oak.** *For. Prod. J.* 5 (1), 1955 (71–6). 8 refs.

The effect of relative-humidity variation on tensile and compressive stresses perpendicular to grain during drying of 2-in. Red Oak [presumably *Quercus borealis*] at 110° F. is reported. The general pattern of strains was similar to that for other hardwoods. *From author's summary.*

4722. OGURA, T. [**Effect of temperature on the moisture conductivity in wood and on the strains developed in wood as it dries.**] *Bull. For. Exp. Sta. Meguro, Tokyo*, No. 77, 1955 (35–68). 13 refs. [Jap.e.]

Using the same material (*Quercus borealis*), technique and laboratory as J. M. McMillen [see preceding abstract] the effects on drying of temperatures of 95, 110, 125 and 140° F. are detailed. The 5-page English summary and 3-page appendix on formula calculations, deal with coefficients for evaporation at constant drying rate, moisture diffusion, moisture conductivity, strain pattern, moisture distribution at maximum strain, magnitude of maximum strain, immediate stress and strain and permanent set, and care in kiln operation.

4723. SUZUKI, Y. **Elastic and plastic strains in dried lumber.** *Trans. 62nd Mtg. Jap. For. Soc.* 1953 (217–9). [Jap.?] From *abstr.* in *Rec. Res. Fac. Agric. Univ. Tokyo* No. 4, 1955 (80). [E.]

Strain distributions in Beech boards, and their changes during drying, were studied. Some of the test results are tabulated, showing for air- and kiln-dried boards ϵ_e and $\epsilon_{e'}$ (immediate and subsequent gradual change in dimension when drying or dried boards are split in thin layers widthwise) and ϵ_p (plastic strain) at different distances from the board surface, and in board during kiln drying to different moisture contents. It is concluded that the apparent shrinkage is affected by plastic strain, which increases with increasing temperature, and that elastic strain is greater in kiln- than in air-dried boards.

4724. KING, W. W. **Cause of and remedy for warped Southern Yellow Pine 2 × 4's.** *Circ. Tex. For. Serv.* No. 37, 1954. pp. 19.

Recommendations for reducing by 85% the number of 2 × 4's likely to warp after manufacture are: avoid excentric logs; avoid logs with marked sweep; avoid logs showing < 4 rings/in. on either end; avoid splitting cants through the pith for the 2-in. dimension; resaw all 2-in. into 1-in. dimension if they have < 4 rings/in. on one end only, or there is an abrupt change in the growth rate.

4725. MCMILLEN, J. M. **Special methods of seasoning wood. Solvent seasoning.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1665–2 (rev.) 1955. pp. 3. 6 refs. P.R.

[Cf. *For. Abstr.* 9 (No. 1757).] Includes a new patent reference.

4726. BIRJUKOV, V. A. [**Conditions of wood seasoning with dielectric and convection-type heating.**]

Derev. lesohim. Prom. 2 (10), 1953 (3–7). [Russ.] From *abstr.* in *Chem. Zbl.* 125 (27), 1954 (6129). [G.] L.S.

A considerable improvement in the quality of material can be obtained when using dielectric drying, if the individual properties of different species are taken into consideration. In particular, woods with poor moisture permeability require careful treatment. Temperature inside the dried material must not exceed 70° C., and the relative air humidity in the kiln should be as high as possible (90–100%).

4727. CHUDNOFF, M. **The effect of zinc chloride on some shrinkage properties of *Eucalyptus rostrata* wood.** *For. Prod. J.* 5 (2), 1955 (139–41). 4 refs. [Ilanoth Research Station, Israel.]

E. rostrata treated with a 5% solution of $ZnCl_2$ showed: (1) a considerable reduction in % of collapse; (2) a noticeable reduction in true shrinkage; (3) when air-dried, a higher equilibrium moisture content than non-treated wood. [Cf. *For. Abstr.* 16 (No. 3545).]

848. *Timberyard Practice. Handling and Storage of Timber*

See also Nos. 4119, 4548.

4728. WRIGHT, C. E. **Growing trend to pallet loading of Southern pulpwood.** *Paper Tr. J.* 139 (12), 1955 (24–6). P.R.

First used in 1948, pallet pulpwood loading is being more and more introduced into industry. The advantages to the mills are discussed, the handling of pallets is described, and the delivery increases are stressed.

85. GRADING OF WOOD AND WOOD PRODUCTS

851. *Timber Quality in General*

See also Nos. 4075–6, 4507, 4510.

4729. QUINNEY, D. N. **Sawtimber quality in Michigan.** *Tech. Note Lake St. For. Exp. Sta.* No. 429, 1955. pp. 2.

Tabulated figures, based on a sample of 558 trees, show the % of merchantable volume found in each log grade by major species, and a second table shows the proportion of merchantable volume in No. 1 and No. 2 logs by species for the principal areas of the state.

4730. PILLAI, P. K. B. **Quality of timber of Engkabang [*Shorea gysbertiana*] grown in plantation.** *Malay. Forester* 18 (2), 1955 (92).

Seven discs cut at different heights from a 15-year-old *S. gysbertiana* tree grown in a mixed plantation were examined for volume of heart rot, volume of sound heartwood, volume of sapwood, and dry weight at 15% m.c. Results are tabulated. Spongy heart was found up to a height of 25 ft.

852. *Detection, Recognition and Assessment of Injuries and Defects*

See also Nos. 4483, 4599, 4718, 4738.

4731. MOSKALEVA, V. E. O smoljanyh karmaškah. **[Resin pockets.]** In *Fiziko-mehaničeskie svoïstva drevesiny*, Goslesbumizdat, Moscow and Leningrad. 1953. pp. 117–21. [Russ.] From *abstr.* in *Referat. Ž.* (*Biol.*) 1954 (1), (No. 591). [Russ.] H.S.B.

Anatomical examination showed that the resin pockets of Spruce are a result of damage to the cambium. Thick-walled parenchyma cells, containing gum and resin, occur along the borders of the resin pocket.

4732. HEISKANEN, V. Vesisilo mäntytukkien laatua alentavana vikana. **[Water-core as a factor diminishing the value of Pine logs.]** *Metsät. Aikak.* 1955 (3/4), (94–6). 15 refs. [Fi.e.]

Discusses theories, mainly those of T. Lagerberg published in 1934–35, on the origin of wetwood of Pine heartwood, and its technical characteristics in respect of floating, seasoning and grading. Proposes grading rules by which no wetwood would be allowed in Class I, some in Class II, and any amount in Class III; wetwood with cracks, however, should not be allowed in any class. *From author's summary.*

4733. YRJÖNEN, E. Metallin etsintä sahatukeista ja sahajätteestä. **[Tracing metal bodies in logs and sawmill waste.]** *Pap. ja Puu* 37 (4*a*), 1955 (127–9). [Fi.e.] P.R.

Gives figures for the number of metal bodies entering the frame saws of one Finnish sawmill in a year and discusses the decreased damage to cutters and the increased output following on the use of a metal detector. [Cf. *For. Abstr.* 15 (No. 3035).]

853. *Grading of Wood in the Rough*

See also Nos. 4588, 4732.

4734. MCCLAY, T. A., and PAWEK, H. J. **The Southern Pine log grades: their application in a stumpage appraisal.** *Sth. Lumberm.* 190 (2379), 1955 (70 . . . 76).

Results of a survey of 239 trees and 1009 logs, using the U.S. Forest Service interim log grades [see *For. Abstr.* 15 (No. 4305)] are given in graphs and tables.

4735. WOLLIN, A. C., and PFEIFFER, J. R. **Oregon Maple log and lumber grading.** *Rep. Ore. For. Prod. Lab.* No. *G*-4, 1955. pp. 7 + 10 tbls. + 2 dgms. + 2 gphs. 6 refs.

Results of grading 367 logs of *Acer macrophyllum* and the 36,580 bd. ft. of lumber sawn from them, showed that the standard log-grading rules of the U.S. Forest Products Laboratory are suitable with only minor alterations and that the lumber-grading rules of the National Hardwood Lumber Association are applicable. Lumber-grade recovery was comparable with that from eastern hardwoods.

854. *Grading of Converted Timber*

See also No. 4735.

4736. BEAZLEY, R. I., and HERRICK, A. M. **Lumber price relatives: their application in the hardwood quality index.** *Sta. Bull. Ind. agric. Exp. Sta.* No. 610, 1954. pp. 30. 14 refs.

[Cf. *For. Abstr.* 15 (No. 4306).] The object of the study was: (1) to determine the effects of time, species, and markets, upon price relatives (p.r. = price per 1000 of any grade in terms of the price

per 1000 of Grade No. 1 C) of the several hardwood lumber grades; (2) to investigate the relations among the influencing factors of time, species, and markets upon price relatives generally; (3) to establish standards for conversion of quality indices among time periods, species groups and markets of the United States.

4737. SCHULZ, H. Grundlagen der Furnierholzbewertung am Beispiel der Eiche. **[Principles of evaluating veneer wood using Oak as an example.]** *Holz-Zbl.* 81 (62), 1955 (759–60). 9 refs. [G.g.]

In the manufacture of sliced Oak veneer a distinction is recommended between features extending along the whole log section (growth-ring structure, colour, spiral grain, curvature) and local defect such as gnarls or burls. It is possible to establish slicing-log grades in accordance with the former features, and three grades accepted in Eastern Germany are characterized in detail. Local defects are then expressed in % of the wood mass, depending on their position in relation to the plane of slicing.

4738. **Grading of sawn British softwoods.** *Leafl. For. Prod. Res., Lond.* No. 49, 1955. pp. 8.

Definitions and nomenclature for defects (illustrated), with a table showing permissible defects and characteristics of grades 1–4.

4739. GRAY, J. M. **The supply and grading of Douglas Fir laminating stock.** *B.C. Lumberm.* 39 (4), 1955 (72 . . . 75).

Describes the difficulties of launching the original specification, and revising it to produce the present Canadian Standards Association specification 0122 for the selection and grading of laminating timber. The most equitable combination of grades to cover the normal distribution in production is suggested, and a plea is entered for the general acceptance of the Standard and for more research on timbers (other than Douglas Fir) e.g. Hemlock, suitable for laminating.

4740. **The Malayan grading rules for sawn hardwood timbers.** Forest Department, Malaya. 1955. pp. 54. Price $1.

Replaces the 1951 edition [cf. *For. Abstr.* 13 (No. 1685)]. The appendix on definitions of defects and the more important terms used in the timber trade has been much enlarged and revised.

86. PULP INDUSTRIES. COMPOSITE MATERIALS MADE WHOLLY OR PARTLY OF WOODY MATTER. CHEMICAL UTILIZATION OF WOOD

See also section 813 and No. 4459.

4741. GLÄSER, H. Verwendung des Holzes unter Auflösung seines Gefüges. **[Utilization of wood by methods that destroy its structure.]** *Kleine Schriftenreihe des Holz-Zentralblatts, Stuttgart* No. 3, 1954. pp. 26 + 7 photos + 1 dgm. 1 ref. [G.] P.R.

A pamphlet containing chapters on: wood pulp; sulphite and sulphate cellulose; fibreboards and chipboards; sugar from wood; destructive distillation; firewood; and gas from wood.

861. *Pulp and Paper Manufacture. Textile and Other Cellulose Derivatives*

See also Nos. 4393, 4427, 4443–5, 4464, 4473, 4503, 4637, 4728.

4742. **List of publications on pulp and paper.** *Rep. U.S. For. Prod. Lab., Madison* No. R444, 1954. pp. 43. P.R.

Includes references to papers by the U.S. Forest Service on: pulpwood; chemical constitution of wood and pulp; and pulping characteristics of woods. The earliest reference dates back to 1924.

4743. **Brown Co. explores wastewood chippers and bark removal methods.** *Paper Tr. J.* 139 (19), 1955 (110–2). P.R.

Describes the operation of Carthage Slab (disc-type) and Equi-Flow (drum-type) chippers, and of a new system of removing the bark from the chips by a combination of abrasion and air aspiration. The machines are used in the chipping of sawmill waste for pulping.

4744. PAULA, R. D. DE GARCIA. **[Rational utilization of *Araucaria angustifolia.*]** *Boletim do INT, Rio de Janeiro* 1 (2), 1951 (38–43). [Port.] From *abstr.* in *Chem. Zbl.* 125 (25), 1954 (5654–5). [G.] L.S.

The main part of the stem can be used for pulpwood, whereas branch knots should be utilized either by condensing their phenol resins with formaldehyde to form plastics, or by using these resins as a shellac substitute or by subjecting the knots to destructive distillation.

4745. L'utilisation des ressources en cellulose des forêts d'Afrique Equatoriale Française. **[The utilization of the pulpwood resources of the forests of French Equatorial Africa.]** *Rev. int. Bois* 22 (203), 1955 (80–4). [F.]

A general account of research in progress, forest inventories etc.

4746. CHIDESTER, G. H. **Use of hardwoods in the manufacture of newsprint.** *Rep. U.S. For. Prod. Lab., Madison* No. 2027, 1955. pp. 7 + 1 tbl. 2 refs. P.R.

Discusses the following subjects: pulping of hardwoods for newsprint, including the new pulping processes; production of newsprint from hardwood pulps; hardwood pulp newsprint furnishes, and paper manufacturing problems.

4747. HYTTINEN, A., and SCHAFER, E. R. **Grinding pretreated hardwoods: experiments on Quaking Aspen, Sweetgum, Red Alder, Black Tupelo, Sugar Maple, Red Oak, and Cottonwood.** *Rep. U.S. For. Prod. Lab., Madison* No. 2015, 1955. pp. 12 + 8 tbls. 6 refs. P.R.

Experiments were made with *Populus tremuloides*, *Liquidambar styraciflua*, *Alnus rubra*, *Nyssa sylvatica*, *Acer saccharum* and *Quercus* sp. The effects of different pretreatment with neutral sulphite solutions are described and tabulated. The results, in addition to the easy bleaching, point to the possibility of substituting semichemical hardwood pulp in part or whole, for mechanical softwood pulp for a variety of uses.

4748. MacLaurin, D. J., and Peckham, J. R. **Kraft pulping and bleaching of some southern hardwoods.** *Tappi* 38 (5), 1955 (283–8). 7 refs. P.R.

Pulping, bleaching, and pulp-strength data are given for kraft pulps made from 11 separate hardwoods: *Quercus stellata*, *Q. alba*, *Q. marilandica*, *Q. nigra*, *Q. falcata*, *Liquidambar styraciflua*, *Nyssa sylvatica*, *Magnolia virginiana*, *Acer rubrum*, *Carpinus caroliniana* and *Liriodendron tulipifera*.

4749. Simmonds, F. A., Kingsbury, R. M., and Martin, J. S. **Purified hardwood pulps for chemical conversion. II. Sweetgum prehydrolysis-sulphate pulps.** *Tappi* 38 (3), 1955 (178–86). 8 refs. P.R.

A series of pulps was prepared from *Liquidambar styraciflua* by the prehydrolysis-sulphate process and a 3-stage purification, the duration of prehydrolysis (at 170° C.) being varied from 0 to 150 min. The unbleached pulps contained 82–95% α-cellulose and 15–1·5% pentosans; the sulphate pulp had ca. 84% α-cellulose and 22% pentosans. Purified pulps had 88–98% α-cellulose and 15–1·3% pentosans. The yield of purified pulp was 41% at pentosan content of 14%, and 30% at pentosan content of 1·5%. Minimum pentosan content was associated with minimum viscosity. [Cf. *For. Abstr.* 14 (No. 3952).] *From authors' summary.*

4750. Jayme, G. L'esame dei diversi legni di pioppo come materia prima per la preparazione della cellulosa. **[The examination of the wood of several species of Poplar as raw material for pulp.]** *Cellulosa e Carta* 6 (3), 1955 (6–21). 25 refs. [It.it.]

Reviews in detail, with experimental data, the work of the author and others, on the physical, mechanical, and chemical properties of Poplar wood and their effect on pulping quality, including methods of analysis.

4751. Chidester, G. H., Seidl, R. J., and Schafer, E. R. **Experiments in the manufacture of newsprint from Cottonwood and Willow.** *Rep. U.S. For. Prod. Lab., Madison* No. 2028, 1955. pp. 10 + 7 tbls. 5 refs. P.R.

Results of comprehensive pulping tests indicate that newsprint can be manufactured from a blend of Cottonwood groundwood and semi-bleached softwood sulphate pulp in the usual proportions. Willow groundwood gave paper of good quality when forming up to 30% of the furnish.

4752. Białobłocki, B., and Borniński, J. **Groundwood manufacture from Poplar.** *Przegląd Papierniczy, Łodz* 10, 1954 (168–72). [Pol.] From *abstr.* in *Chem. Abstr.* 49 (8), 1955 (5830). L.S.

Large-scale experimental trials showed that a satisfactory groundwood pulp can be produced from sound, knot-free Poplar by maintaining the temperature in the grinder trough below 50° C., pulp consistency below 2%, and the pressure of wood on the stone about 1 kg./sq. cm., and by using a fine-grain stone. Substitution of 10% Poplar groundwood for an equal amount of Spruce groundwood in a 60/40 sulphite/groundwood furnish, gave a writing paper of good quality.

4753. Krzysik, F., and Gonet, B. **Poplar as a raw material for pulp and paper.** *Przegląd Papierniczy, Łodz* 10, 1954 (161–8). [Pol.] From *abstr.* in *Chem. Abstr.* 49 (8), 1955 (5830). L.S.

The growth rate, physical and mechanical properties, and pulp yields of 5 species of Poplar, viz. *Populus canescens* (*A*), *P. berolinensis* (*B*), *P. deltoides* (*C*), *P. alba*, and *P. tremula*, all grown in Poland, were evaluated. *C* had the highest growth rate and best mechanical properties, and *A* had the highest density and gave the highest pulp yield on cooking with 18% active alkali. *B* and *C* are considered the best pulpwood species for growing in Poland, from both the technical and the economic standpoint.

4754. Yonezawa, Y., Kayama, T., and Takano, I. **[Pulp from Japanese *Eucalyptus globulus*. Part 1. Sulphate and neutral sulphite semichemical processes.]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 76, 1954 (181–8). 6 refs. [Jap.jap.e.]

Compares the fibre dimensions, densities, chemical constitution and the strength of unbleached and bleached sulphate pulps with those of Beech [*Fagus crenata*] and gives similar data for the semi-chemical pulp, the cooking conditions being detailed in each case. These pulps are superior to general hardwood pulp and almost the same as Red Pine [*P. densiflora*] in strength, but there are difficulties in bleaching.

4755. Koeppen, A. von, and Cohen, W. E. **Pulping studies of five species of a Mangrove association.** *Aust. J. appl. Sci.* 6 (1), 1955 (105–16). 19 refs. P.R.

[Cf. *For. Abstr.* 15 (Nos. 904, 4319).] Eight butt samples of *Rhizophora apiculata*, two samples of *Camptostemon schultzii*, and one each of *Sonneratia acida*, *Bruguiera gymnorrhiza*, and an unidentified species of *Excoecaria*, were subjected to chemical and morphological examination and pulped by the sulphate process. The chemical and morphological characteristics of their sulphate pulps were determined and the pulps evaluated. The chemical characteristics were found to resemble those of other hardwoods. The cell-wall thickness and its ratio to diameter of lumen indicates that *B. gymnorrhiza* and *R. apiculata* are less suitable for pulping than the other three species. The investigation shows that sulphate pulps of good strength properties can be produced from these other three Mangroves. *From authors' summary.*

4756. Richter, G. A. **Production of high alpha-cellulose wood pulps and their properties.** *Tappi* 38 (3), 1955 (129–50). P.R.

It is suggested, on the basis of the research described, that a better understanding of the significance of α-cellulose values would be obtained if these figures were regularly corrected for other alkali-resistant components and if α-cellulose were further characterized by its resistance to boiling 7·14% NaOH solution. Methods that can be used for preparing high-α-cellulose wood pulps are reviewed [no bibliography given]. Multiple-stage pulping as a means of obtaining very high α-cellulose levels is discussed in some detail. Methods are described for eliminating hemicellulose by weak cuprammonium solutions and also by freezing. *From author's summary.*

4757. Jayme, G., and Licht, W. Beiträge zur Kinetik und Systematik des alkalischen Aufschlusses von Buchenholz. **[Contributions to the kinetics and**

systematics of the alkaline pulping of Beech.] *Holzforschung, Berlin* 9 (2), 1955 (33–48). 80 refs. [G.g.e.] P.R.

Presents in tables and graphs the results of various experiments on the pulping of Beech sawdust. Recommends the introduction of specific factors to characterize the pulping capacity of a liquor; these factors are equal to the ratio of the amount of chemical actually used (e.g. NaOH or Na_2S) to the required minimum. [Cf. *For. Abstr.* 16 (No. 1192).]

4758. GORHAM, A. B. **The determination and verification of unbleached sulphite yield.** *Pulp Paper Mag. Can.* 56 (3), 1955 (159–62). 2 refs.

Details a method of drawing samples and using mill output statistics for a factory-scale check of yield by carrying out a materials balance on each digester. A table shows the calculated and actual total solids over a 10-month period and a straight-line relation is plotted for total solids per digester against % yield.

4759. **Can nitric acid pulping succeed commercially?** *Paper Tr. J.* 139 (24), 1955 (22, 24–5). P.R.

A detailed description of the Delbay process covered by U.S. Patent No. 2,571,993. It is claimed that this cold process combines high yield and high-quality pulp with low plant investment and low production cost.

4760. RØED, H. Sopp og tremasse. [**Fungi and mechanical pulp.**] *Norsk Skogind.* 9 (4), 1955 (123–31). [Nor.e.] P.R.

A short account of the fungi causing the damage, the sources of infection, and control measures.

862. *Composite Materials made Wholly or Partly of Woody Matter.*

See also Nos. 4447, 4516, 4546, 4576, 4637.

4761. LIIRI, O. Kuitulevyjen laatuvaatimukset ja tutkimusmenetelmät eri maissa. [**Specifications and testing methods for fibre boards in different countries.**] *Pap. ja Puu* 37 (4), 1955 (175–88). [Fi.e.] P.R.

Standards of U.S.A., European countries, and FAO, are tabulated.

4762. NORTHCOTT, P. L. **Possibilities of the glueline-cleavage test when applied to hardboard [with discussion].** *For. Prod. J.* 5 (1), 1955 (61–4).

Discusses the possibilities of this method. [Cf. *For. Abstr.* 14 (No. 2731).]

4763. RAUCH, A. H. **Application of available glue line test methods to hardboard.** *For. Prod. J.* 5 (1), 1955 (64–6).

Different test methods (shear and exposure tests) were applied and their suitability for testing hardboard is discussed.

4764. **Board materials. Types and applications.** *Wood* 20 (4), 1955 (133–62).

A symposium covering the use of fibreboard in temporary and permanent shuttering for concrete; walls, ceilings and interlocking partitions; floor coverings and underlays; surface-coated and decorative boards; conditioning; flush doors; metal fixings; and of chipboards in general application and for furniture making.

4765. BOIS, P. **Wood residues in compression-molded and extruded products.** *Rep. U.S. For. Prod. Lab., Madison* No. 1666–7 (rev.) 1955. pp. 7. 7 refs. P.R.

General description of the following wood-waste based products: moulded wood-fibre products and moulding of resin-bonded wood particles. Methods of reducing the resin content of board products and of applying shape-moulding are also discussed.

4766. KOLLMANN, F. Europäische Methoden zur Herstellung von Holzspanplatten. [**European methods of manufacturing chipboards.**] *Holz-Zbl.* 81 (52), 1955 (642–3). [G.]

Brief descriptions of procedures used (the name of the company or the product is given): JI-TE Fabrikker, Åstorp, Sweden; Novopan; Curvi-Board; Interwood; Behr boards; Wirus boards; Okal boards; Norddeutsche Homogenholz-Werke; Rowi boards; Tavapan; Bremmer boards; Bartrev boards; Weyroc boards; Plimberite boards, and Qvenild boards.

4767. BUXBAUM, H. Spånskivor. [**Chipboards.**] *Svensk PappTidn.* 58 (6; 7), 1955 (196–204; 240–9). 27 refs. [Sw.sw.e.] P.R.

Discusses raw materials, equipment and different types of board, and the economics of chipboard production.

4768. FAHRNI, F. **Process for manufacturing a composite wooden board.** *U.S. Patent* No. 2,686,143, Aug. 10, 1954. pp. 5 + 4 dgms. 8 refs. P.O.

The chipboard consists of a middle layer of coarser material, and two thin face layers of fine, selected material, the 3 layers being first pre-compressed separately with the binder added, and then made into one panel.

4769. BASLER, H. **Improvements in or relating to the manufacture of fibre boards.** *Brit. Patent* No. 680,367, Oct. 1, 1952. pp. 3. P.O.

Wood pulp containing 20–70% of wood chips impregnated with synthetic resins or the like is mixed with a suitable binder and moulded in hot presses.

4770. ÖMAN, E. Verfahren zur Herstellung von Faserplatten. [**Method of manufacturing fibre-boards.**] *Austrian Patent* No. 177,929, March 25, 1954. pp. 3 + 1 dgm. [G.] P.O.

Fibreboards are made from a mixture of wood fibres and the fibrous mass obtained from straw by suitable digestion.

4771. HELLEFORS BRUKS AKTIEBOLAG. Procédé de fabrication de plaques, carton, papier, corps moulés et analogues à partir de matière fibreuse végétale. [**Method of manufacturing boards, cardboard, paper, moulded objects and the like from fibrous plant material.**] *French Patent* No. 1,022,145, Feb. 27, 1953. pp. 3. [F.] P.O.

Example: sawdust is subjected to further comminution while heated at ca. 80° C. in a 0·1–0·7% NaOH solution. The fibrous mass is then moulded or pressed, and dried.

4772. MARTINSON, G. M. Aus Faserstoff und Bindemittel aufgebaute faserige Masse mit Isoliereigenschaften und Verfahren zu ihrer Herstellung. **[Fibrous mass composed of fibrous material and a binder, and method of manufacture.]** *German Patent* No. 898,271, Nov. 30, 1953. pp. 2. [G.] P.O.

Comprising 90–95% of fibre waste from vibration screens in pulp plants and 5–10% Portland cement, with or without waterglass.

4773. LUXFORD, R. F. **Properties of insulating fiberboard sheathing.** *Rep. U.S. For. Prod. Lab., Madison* No. 2032, 1955. pp. 6 + 4 photos + 8 gphs. + 2 tbls. 2 refs. P.R.

Presents the results of tests of bending strength, lateral and direct nail-withdrawal resistance, linear expansion, water absorption and thermal conductivity for 14 different commercial insulation fibreboards, all of which have met the commercial standard. These boards should be kept dry during erection.

4774. NARAYANAMURTI, D., and SINGH, H. **Studies on building boards: part VIII—production of building boards from various woods and barks by defibration.** *Comp. Wood* 2 (1), 1955 (6–15). 9 refs. P.R.

[Cf. *For. Abstr.* 16 (No. 2461).] Presents data on experiments for manufacturing fibreboards from waste veneers of *Adina cordifolia*, *Pinus excelsa*, *Cedrus deodara*, *Cedrela toona*, *Dysoxylum malabaricum*, *Zanthoxylum rhetsa*, Kanju bark, tannin-extracted Sal bark, Areca-nut husk, and Bamboo shavings, using the Asplund process. Includes tables on: physical and chemical examination of woods and barks used; chemical composition of pulps; properties of fibreboards obtained; alkali treatment and yield; properties of boards and conditions of pressing; properties of resin-impregnated boards; flow resistance of insulation boards.

4775. FARMER, R. H., and PACKMAN, D. F. **The production of hardboard from tropical timbers. 1. Kempas (*Koompassia malaccensis*).** *Colon. Plant. Anim. Prod.* 4 (4), 1954 (1955), (293–309 + 2 photos).

Standard hardboard and super hardboard, according to British Standard 1142 (1953), were made on an experimental scale from Kempas by a modified neutral sulphite semi-chemical process in which the yield of usable pulp was high and the consumption of chemical was low. Chips cooked for 30 minutes with 3·5% sulphite were passed once through a disc mill fitted with coarse plates and the complete range of the resulting fibres was incorporated into boards without further refining. Tempering with small additions of linseed oil up to 3·5% of their weight enabled boards to meet all requirements for British Standard and Super Hardboard. *Authors' summary.*

4776. KITAHARA, K., and SAKURAI, R. **A study on the cutting of hard fiber-board. (1) Sawing by circular saw.** *Trans. 62nd Mtg. Jap. For. Soc.* 1953 (244–5). [Jap.?] From *abstr.* in *Rec. Res. Fac. Agric. Univ. Tokyo* No. 4, 1955 (78). [E.]

863. *Wood Hydrolysis. Saccharification*

4777. LLOYD, R. A., and HARRIS, J. F. **Wood hydrolysis for sugar production.** *Rep. U.S. For. Prod. Lab., Madison* No. 2029, 1955. pp. 9 + 1 dgm. + 2 tbls. 1 ref. P.R.

Describes the rapid percolation process developed at Madison, lists the equipment needed for a wood-sugar molasses plant, and discusses the economic value of sugar molasses, and other uses for wood sugar.

4778. Furfural: de vervaardiging van furfural uit loofhout. **[Furfural: the manufacture of furfural from hardwoods.]** Centrum voor Landbouwdocumentatie, Wageningen. 1954. pp. 1.

A bibliography containing 18 references.

864. *Utilization of Lignin*

See No. 4579.

865. *Plastics*

See also No. 4765.

4779. KAHANE, L. (to Laboratoire de Recherches et de Contrôle du Caoutchouc et de l'Amiante). Procédé de traitement de matières ligneuses. **[Method of treating woody material.]** *Canadian Patent* No. 492,304, April 21, 1953. pp. 4. [F.] P.O.

Example: wood flour, with or without an addition of lignin (e.g. black liquor) is treated with formaldehyde, with or without phenolic compounds; the final product is a moulding powder.

866. *Utilization of Wood Extractives*

See also Nos. 4744, 4788, 4796.

4780. MEDNIKOV, F. A., and GURIČ, N. A. **[Processing of fresh stump resin.]** *Derev. lesohim Prom.* 2 (10), 1953 (19–20). [Russ.] From *abstr.* in *Chem. Zbl.* 125 (33), 1954 (7522). [G.] L.S.

Stumps of freshly-felled trees can be processed in the same way as mature wood. The rosin obtained contains more fatty acids and less oxidized substances than usual; the turpentine was found to have the following properties; $n_D^{20} = 1{\cdot}4695$; $d_4^{20} = 0{\cdot}8624$; acid value 0·014; saponification value 3·6.

4781. KOMŠILOV, N. F., LETONMJAKI, M. N., and SPIRKOVA, L. I. **[Composition of resin extracted from old Pine stumps.]** *Derev. lesohim. Prom.* 3 (4), 1954 (11–2). [Russ.] From *abstr.* in *Holzforschung, Berlin* 9 (3), 1955 (93). [G.] P.R.

Resins extracted from decayed stumps 30 years after felling have practically the same composition as those from regular tapping.

4782. **Muhuhu oil from Tanganyika.** *Colon. Res., Lond. 1953/1954*, 1954 (28).

A sample of *Brachylaena hutchinsii* wood from Tanganyika yielded 1·4% of a fairly viscous,

greenish-yellow oil, having a stronger and cleaner odour, and being richer in alcohols, than samples distilled in E. Africa. [Cf. *For. Abstr.* 16 (No. 2476).]

867. *Destructive Distillation*

See also Nos. 4744, 4788.

4783. Ross, J. D. [Compiler]. **Bibliography of wood distillation, 1907–1953.** Oregon Forest Products Laboratory, Corvallis. 1955. pp. 55.

Covers world-wide published work in the divisions: (1) books, listed alphabetically by author's name; (2) articles and bulletins, listed chronologically and by author's name under each year; (3) patents, listed chronologically under each country and by author's name under each year. *Chemical Abstracts* references are included where possible.

4784. Rouet, G. L. M. Procédé de traitement de matière hydrocarbonée et installations de mise en œuvre de ce procédé. [**Method of processing carbohydrate matter and apparatus therefor.**] *French Patent* No. 1,028,070, Sept. 24, 1953. pp. 2. [F.] P.O.

Comminuted matter (e.g. sawdust) is immersed in molten metal so as to effect complete destructive distillation.

4785. Takemori, T., and Akazawa, S. [**Studies on the carbonization of wood (III). With special reference to the change of physical and chemical properties of carbonization products in the course of destructive distillation of green wood.**] *Report of the Faculty of Agriculture, Shizuoka University, Iwata* No. 3, 1953 (158–65). 2 refs. [Jap.jap.e.]

A detailed study for *Pinus densiflora*, *Phyllostachys reticulata* and *P. nigra* var. *henonis*, supported by numerous graphs and tables, and compared with previous results for *Quercus phillyraeoides* and *Paulownia tomentosa*. [Cf. *For. Abstr.* 15 (No. 4359).]

4786. Kotok, E. S. **The production of charcoal from Arizona Mesquite.** *Res. Note Rocky Mt. For. Range Exp. Sta.* No. 15, 1955. pp. 6. 2 refs.

Results of laboratory analysis of charcoal produced experimentally indicate that a good grade of barbecue' charcoal can be produced from *Prosopis* spp. Preparation of the raw material, kiln operations, handling the finished products, and financial aspects are discussed.

89. OTHER ('MINOR') FOREST PRODUCTS

See also section 28.

892. *Vegetable Products*

See also No. 4098.

892.1. Grass. Litter. Leaf Fodder

See No. 3766.

892.4. Bark Products. Tanstuffs. Cork

See also Nos. 3853, 4107–9, 4774, 4796.

4787. Yagüe Gil, A. Contribución al aprovechamiento tánico de la corteza de pino española. [**Tannin from the bark of Spanish Pines.**] *Comun. Inst. for. Invest. Exp. Madrid* No. 1, 1955. pp. 22. 11 refs. [Span.]

Investigations were made on Pine bark left for some time in the forest, and freshly peeled Pine bark, in order to find whether bark abandoned in the forest could be utilized for tannin extraction. Results are presented of (*a*) analyses of bark of *Pinus sylvestris* and *P. pinaster*, from Guadalajara, previously exposed to the air for a varying number of months, (*b*) pilot-plant tests with *P. pinaster* bark. These confirm previous conclusions that bark exposed for any length of time in the open air undergoes chemical changes of such magnitude as to render it practically useless for tannin extraction.

4788. Michel, R. Industrialización forestal en Durango. [**Industrial uses of the forests in Durango.**] *Mensajero for., Durango* No. 128, 1955 (16–20). [Span.]

Presents figures showing the costs of 4 different types of process: (1) extraction of tannin from bark of Pine, Oak and *Acacia*; (2) dry distillation of Pine stumps for tar, acetone, alcohol and acetic acid; (3) extraction of resin, turpentine and essential oils from Pine stumps; and (4) conversion of sawdust into wood flour.

4789. Rao, J. B., Nayudamma, Y., and Das, B. M. **A survey of the indigenous tanning materials of the Madras state: Part I—White-Valem bark (*Acacia leucophloea*).** *J. sci. industr. Res., India* 13*B* (12), 1954 (867–73) 10 refs. D.S.I.R.

Chemical examination of the bark and practical tanning trials have shown it to be a satisfactory substitute for Wattle bark.

4790. Gupta, S. R., Kurth, E. F., and Seshadri, T. R. **Colouring matter of Ponderosa Pine bark.** *J. sci. industr. Res., India* 13*B* (12), 1954 (886–8). 3 refs. D.S.I.R.

The bark has been found to contain quercetin and myricetin along with dihydroquercetin.

892.5. Medicinal Plants, Edible Plants, Insecticides from Plants etc.

4791. Willaman, J. J., and Schubert, B. G. **Alkaloid hunting.** *Econ. Bot.* 9 (2), 1955 (141–50). 32 refs.

Lists the 283 Angiosperm families, each with its total number of species and the numbers in which the presence or absence of alkaloids had been proved by 1952. Recent exploration for sources is reviewed and the most likely families for further work are indicated.

4792. Badhwar, R. L., Karira, G. V., and Ramaswami, S. ***Rauwolfia serpentina*—the wonder drug of India (Rauwolfia, Sarpagandha).** *Indian For.* 81 (4), 1955 (258–68 + 2 photos).

Gives an account of the plant, its distribution, the alkaloids isolated from it, and their use in medicine. The demand for roots is now far greater than the available supply, and research has been carried out at the Forest Research Institute, Dehra Dun, on the possibility of its cultivation. The authors have found that there is no significant difference in the yield of total alkaloids in the roots grown under

agricultural conditions and naturally in the forest. Details of cultivation and harvesting are given. Plantations are best raised from seed, but propagation by root or stem cuttings is also possible. It should be possible to obtain a yield of ca. 2000 lb. of air-dry roots (including fibrous roots) per acre from a 2-year-old, and ca. 3000 lb. from a 3-year-old plantation, under irrigated agricultural conditions on sandy clay-loam soil. *From authors' summary.*

4793. BOUTIQUE, R., and MONSEUR, X. Les alcaloïdes du genre '*Rauvolfia*' et l'étude botanique de ses espèces au Congo belge. **[The alkaloids of the genus *Rauwolfia* and the systematy of its Belgian Congo species.]** *Bull. agric. Congo belge* 46 (2), 1955 (271–80). 32 refs. [F.flem.]

Provides a key, illustrations, and notes on habit and occurrence for the 8 local species, and gives a classified list of the 24 alkaloids so far isolated. The local *R. vomitoria* and *R. obscura* contain some of these. Pharmacological properties are indicated.

4794. GILLOT, J. Quelques observations sur la récolte dans les friches de racines de *Rauvolfia vomitoria* Afz. **[Notes on harvesting the roots of *R. vomitoria*.]** *Bull. Inform. Inst. nat. Étude agron. Congo belge* 4 (2), 1955 (83–8). [F.]

Covers conditions influencing yield, uprooting with a cassava root lifter, treatment of roots and amounts collected per man-day.

4795. TERRIOUX, J. Recherches botaniques, chimiques et pharmacodynamiques sur les *Mansonia* africains. **[Botanical, chemical and pharmaceutical researches on African *Mansonia* spp.]** Imprimerie de la Presse, 37 Rue Fontenelle, Le Havre. 1952. pp. 113. 58 refs. [F.]

From morphological and anatomical examination of the herbarium material available, it was impossible to establish *M. altissima* and *M. nymphaeifolia* either as separate species or as varieties of the same species. The analysis of the root and stem barks, the leaves and the fruits, and 11 methods for the separation of the active principle, crude mansonine, are detailed. Paper chromatography indicates that crude mansonine consists of 3 nearly related substances. One (separated on the column), for which the name mansoneine is proposed, has a melting point of 224–226°. The physiological reactions of laboratory animals to crude mansonine (shown in lethal dosage and cardiograms) are similar to those to the true cardiotonics but these reactions vary with the toxicity which depends not only on the species but also on the provenance, age of the plant etc. The toxicity of root and stem barks is similar, that of the leaves and fruits much less. Work on the standardization of the raw product is required.

892.6. Resin and Turpentine. Essential Oils. Fixed Oils and Fats. Gums. Latex Dyestuffs. Sap Sugar

See also Nos. 4112–4, 4459.

4796. ANDERSON, A. B. **Recovery and utilization of tree extractives.** *Econ. Bot.* 9 (2), 1955 (108–40). 58 refs.

A general review covering resins and turpentines, tannins and dyes, volatile oils, exudates etc. and including chemical composition, collection, commercial sources, processes, applications, yields and production statistics.

4797. HODGE, W. H. **Some new or noteworthy industrial raw materials of plant origin.** *Econ. Bot.* 9 (2), 1955 (99–107). 38 refs.

Covers fats, oils, waxes, gums, and resins (31 items) with details of their chemical properties and utilization. Of the 38 references, 36 date from 1951.

4798. LOZANO LÓPEZ, V. La industria resinera española. **[The Spanish resin industry.]** *Suppl.* to *Revista Sindical de Estadística, Madrid* No. 29–30, 1953. pp. 23. [Span.] Price *Ptas.*10 [*3s. 6d.*]

A short account of its history since the middle of the 19th century and its present place in the social and economic order, including notes on species tapped, average yields per tree, locality of the main stands, uses of products (with a list of the main resin undertakings), national production of resin and its products, and domestic consumption.

4799. **Slash Pine from British Honduras.** *Colon. Res., Lond. 1953/1954*, 1954 (28–9).

In a large-scale tapping trial carried out on *Pinus caribaea* in British Honduras, the yield was lower than that from *P. elliottii* in the southern U.S.A. Steam distillation of a sample of oleoresin gave good-quality turpentine and rosin. [Cf. *For. Abstr.* 16 (No. 2504).]

4800. COVENEY, R. D., ISLIP, H. T., and MATTHEWS, W. S. A. **A second large-scale distillation trial of Slash Pine oleo-resin from British Honduras.** *Colon. Plant. Anim. Prod.* 4 (4), 1954 (1955), (313–8).

[Cf. preceding abstract.] Turpentine and rosin obtained from acid-treated and untreated trees were comparable in quality. The softening points of both samples of rosin were slightly lower than the minimum recorded for American rosins, but otherwise the constants obtained lay within the normal range.

4801. CHOPRA, R. S. **Rosin and turpentine industry in Punjab (India).** *Indian For.* 81 (4), 1955 (252–7 + 1 dgm.).

Describes the method of tapping and processing resin from *Pinus longifolia*, and briefly discusses the problems of channel exhaustion, destructive private tapping and crude distillation, the modern Jallo factory having been lost to Pakistan at partition.

4802. KHAN, A. AZIZ. **Essential oil industry in Pakistan.** *Pakistan J. For.* 4 (4), 1954 (285–300). 12 refs.

4803. LÁNYI, J. Fenyötüolay termelés. **[Essential oil production from conifer needles.]** *Erdész. Tud. Int. Évk.* 2, 1952 (1954), (243–7). [Hu.russ.e.g.]

Tables are presented showing (1) the relation between the volume of timber (Derbholz) and the amount of needles suitable for distillation ; (2) the quantity of volatile oil, as a % of fresh needle weight, obtainable under Hungarian conditions, at different times of year from Scots Pine, Norway Spruce and Silver Fir, and in February from Austrian

Pine (from Scots Pine ca. 0·25% may be expected in the winter months); (3) results of a 44-day experiment in storing fresh needles, which showed that in winter Scots Pine needles can be piled 1 m. high without loss of volatile oil.

4804. FAHEY, M. D., and KURTH, E. F. **Composition of the volatile oil from the foliage and terminal branches of Western Juniper [*Juniperus occidentalis*].** *Repr.* from *J. Amer. pharm. Ass. (sci. Ed.)* 44 (2), 1955 (87–9). 9 refs.

4805. FUJITA, N. **[On the essential oil of *Thujopsis* species grown in several prefectural districts of Japan.]** *Bull. For. Exp. Sta. Meguro, Tokyo* No. 76, 1954 (175–9). 4 refs. [Jap.jap.e.]

Thujopsis dolabrata gave ca. 0·1% of essential oil against 0·7–1·0% for *T. dolabrata* var. *hondai*. The sesquiterpene of these oils was a tricyclic sesquiterpene (thujopsene). A bicyclic type was not detected.

4806. FRANKLIN, T. O cumarú das caatingas (*Amburana cearensis* (Fr. All.) A. C. Smith). **[*A. cearensis*.]** *Arq. Serv. flor., Brasil* 6, 1952 (1–124). 38 refs. [Port.port.e.]

In the past, *A. cearensis* has been exploited in Brazil solely for timber, while coumarin has been imported. An intensive study of the tree is presented with a view to possible chemical exploitation. Information is given on nomenclature, uses, distribution, morphology and taxonomy, with special reference to means of identification. A section is devoted to the extraction of coumarin and its uses, and extensive data are presented on the physical and mechanical properties of the wood.

4807. STANISLAUS, P. R. **Jelutong. A Sarawak latex and timber tree.** *Wood* 20 (4), 1955 (169).

Notes on the comparative importance of Swamp Jelutong (*Dyera lowii*), the chief source, and Hill Jelutong (*D. costulata*); tapping, yield, preparation and export of the latex (ca. 1000 tons/year); and uses of the timber.

892.7. Fruits. Seeds. Fibres, Yarns and Flosses

See also Nos. 3853, 3859, 3985–6, 4110–1.

4808. RANKOFF, G., and POPOW, A. Untersuchungen über die Früchte von *Pirus aucuparia* Gärtn. **[Investigations of the fruit of *Sorbus aucuparia*.]** *C.R. Acad. bulg. Sci.* (*Sci. math. nat.*) 7 (1), 1954 (5–8). 7 refs. [G.russ.] E.M.B.

Chemical constituents and uses.

4809. NAISMITH, W. E. F. **The protein from *Balanites aegyptiaca* [nuts].** *Nature, Lond.* 175 (4459), 1955 (692).

4810. MOURANCHE, R. Le palmier raphia de Madagascar. **[The Raphia Palm of Madagascar.]** *Bois For. Trop.* No. 41, 1955 (8–18). 7 refs. [F.]

Describes the biology and ecology of *Raphia ruffia*, with data on its utilization, quantities of raffia used locally and exported, protection policy and measures for improving and extending the existing stands.

893. *Animal Products*

4811. KARAMCHANDANI, K. P. **Honey from Mahableshwar forests.** *Indian For.* 81 (4), 1955 (248–51 + 1 plate).

Includes data derived from chemical analysis of honey samples from 6 localities.

9. FORESTS AND FORESTRY FROM THE NATIONAL POINT OF VIEW. SOCIAL ECONOMICS OF FORESTRY

90. GENERAL

4812. **Rehabilitation and development of agriculture, forestry, and fisheries in South Korea.** Columbia University Press, New York. 1954. pp. xviii + 428 + 5 maps. *Price* $8·75. X.

A report prepared for the U.N. Korean Reconstruction Agency by a mission selected by FAO. The section on forestry (pp. 315–74) has chapters on general background, the forest, and past and present forest organization, and recommends programmes of land use, forest legislation, forest organization, forest research, and finance.

902. *History of Forests and Forestry*

See also No. 4060.

4813. TURC, L. Quelques aspects du problème forestier en Franche-Comté au XVIII[e] siècle. **[Some aspects of the forestry problem in Franche-Comté in the 18th century.]** *Bull. Soc. for. Franche-Comté* 28 (4; 5), 1954–5 (184–92; 216–28). 25 refs. [F.]

4814. DENUYL, D. **Indiana's old growth forests.** *Proc. Indiana Acad. Sci.* 63, 1953 (73–9). 3 refs. A.P.B.

A brief history, with some figures for Indiana hardwood lumber production from 1869 to 1945.

903. *Forest Policy, General*

See also Nos. 4075–6.

4815. CHAPMAN, G. W. **Recommendations regarding the future administration of the minor forests and for the establishment of a central forest fund for the minor forests [in Cyprus].** Conservator of Forests, Nicosia. *C. of F.* No. 67/44, [1954?] pp. 12 + tbl.

4816. TOTHILL, A. H. **Aims in the Imatongs [on the Sudan/Uganda border].** *Emp. For. Rev.* 34 (2), 1955 (173–6 + 10 photos).

A short account of the forests and the policy adopted for their management.

4817. WORRELL, A. C. **Forest production in a dynamic economy**. *J. For.* 53 (6), 1955 (447–50).

The author points out that if the 1939 consumption of Southern Pine pulpwood had been accepted for fixing the yield of those forests, only ⅓ of the 1952 consumption would have been met. Assuming other variables constant, he considers in a simplified model the implications of an annual increase in consumption of 5% (bearing in mind that U.S. pulpwood consumption rose during 1900–1950 by 5·3% annually) assuming that all the stands are even-aged, clear-felled and replanted at 30 years; and discusses what area should have been planted in 1939 for 1969 and what effect consumption trends in excess of or below the estimated 5% would have on future planting and on the rotation. He concludes that policy should estimate future production, add 10%, and plant for that.

4818. LEHOTSKY, K. **The development of Brazilian forest policy**. *Arq. Serv. flor., Brasil* 7, 1953 (151–203). 24 refs. [E.port.]

Presents a short history of exploitation, settlement and legislation in the different phytogeographical regions of Brazil.

4819. **Colony of Sarawak: statement of forest policy**. Government Printing Office, Kuching. 1955. pp. 4.

904. *General Regional Accounts of Forests and Forestry*

See also No. 4437.

4820. ROL, R. Le Cachemire et ses forêts. **[Kashmir and its forests.]** *Rev. for. franç.* 7 (6), 1955 (461–75 + 8 photos). [F.]

4821. DAL, C. La forêt vietnamienne. **[The forests of Viet Nam.]** *Rev. int. Bois* 22 (203), 1955 (75 . . . 79). [F.]

The 13 million ha. of forest in Viet Nam cover almost half the area of the country and are largely inaccessible at present, there being but 3000 km.of road and 25 km. of railway.

4822. CHAMPSOLOIX, R. La forêt des pays montagnards du Sud Vietnam et ses produits. **[The forests of the mountainous region of south Viet Nam and their products.]** *Bois For. Trop.* No. 40, 1955 (3–12). [F.]

4823. TRESCHOW, F. M. Litt om Teneriffe og skogplanting der. **[Teneriffe and forest planting carried out there.]** *Tidsskr. Skogbr.* 63 (3), 1955 (82–8). [Nor.]

Deals mainly with treatment in nurseries and planting out of *Pinus canariensis*.

4824. GAILLEZ, L. Monographie forestière du Maniema. **[Forestry in Maniema [district, Belgian Congo].]** *Bull. agric. Congo belge* 46 (2), 1955 (282–318). [F.flem.]

A conspectus of forestry in the area between 1 and 4° S. lat., eastwards from the Lualaba, including geology, vegetation, forest composition, exploitation, allowable cut, production 1948–53, sawmilling economics, departmental organization, reservation and regeneration by strips.

4825. CAPURON, M. Compte rendu d'une tournée dans les forêts du nord de Madagascar, avec le professeur Humbert. **[Account of a tour in the forests of northern Madagascar with professor Humbert.]** *Bulletin de l'Académie Malgache, Tananarive (n.s.)* 30, 1951/52 (27–35). [F.] L.S.

Brief notes on some of the principal forest regions.

4826. **Saskatchewan's forests: a report prepared by the Department of Natural Resources, Province of Saskatchewan**. Department of Natural Resources, Regina, Saskatchewan. 1955. pp. 129.

Deals with the accessible, productive forests of the province, covering forest resources, forest policy, and forest industries.

4827. MCGRATH, K. P. **Possibilities of timber industrial development in the Amazon valley**. *Trop. Woods* No. 101, 1955 (43–52).

A general note on the economy, climate, topography, forests, and opportunity for forest development. Considerable areas have sandy soils where shifting cultivation relies exclusively on fallow for fertilization.

4828. VEILLON, J. P. Unos aspectos forestales de Peru. **[Some aspects of the Peruvian forests.]** *Bol. Ingen. for. Univ. los Andes* 1 (6), 1954 (3–36 + 3 maps + 4 photos). 5 refs. [Span.]

The data, collected during a course on tropical forestry organized by the Zona Andina del Instituto Interamericano de Ciencias Agricolas in Peru in 1954, include information on: the physical geography, climate and natural forests; the distribution, growth, artificial regeneration and economics of *Eucalyptus*; the stands of Cético (*Cecropia* sp.) in the R. Ucayali region, their rôle as a pioneer species in the formation and development of alluvial soils in the river basin, their growth, and potential as a commercial crop; and the timber industry of Peru, exploitation, costs and prices, production, and exports and imports.

905. *Forest Statistics and Resources*

4829. **World forest resources: results of an inventory undertaken in 1953 by the Forestry Division of FAO**. FAO, Rome. 1955. pp. vi + 120. [E.F. Span.]

Tabulated data by countries include statistics for categories of land; classification of accessible forests; classification, growing stock, gross increment and net growth, growth and allowable cut, fellings and logging and floating losses, and removals (all for forests in use); roundwood taken from trees outside the forest; changes in forest resources.

4830. Oversigt over de danske Statsskoves udbytte af ved og penge for finansåret 1953–54. **[Review of the timber and financial yields of the Danish State forests for the financial year 1953–54.]** Nielsen & Lydiche (M. Simmelkiær), Copenhagen. 1955. pp. 16 + 1 tbl. [Dan.]

4831. Japan—skogressurser og skogindustri. **[Japan—forest resources and the [output by the] forest industry.]** *Norsk Skogind.* 9 (4), 1955 (112–7). [Nor.] P.R.

4832. KABZEMS, A. [Editor]. **Forest resources of the Cumberland Lake/Flin Flon area of Saskatchewan.** *For. Invent. Ser. For. Br., Sask.* No. 4, 1955. pp. 32.

4833. MCCORMACK, J. F. **17-year trends of timber volume in the northern coastal plain of North Carolina.** *Res. Note Stheast. For. Exp. Sta.* No. 80, 1955. pp. 2.

Tabulated figures compare sawtimber volume and cu. ft. volume of all trees of 5·0 in. d.b.h. and larger for 1937 and 1955 for Pines, hardwoods and Cypress/Cedar.

4834. **Forest statistics for California.** *For. Surv. Release Calif. For. Range Exp. Sta.* No. 25, 1954. pp. 66 + 1 map.

The position on 1 Jan. 1953, based on data collected from 1946 to 1952.

907. *Indirect Significance of Forests (Rural Amenity, National Parks, Forest Influences etc.)*

See also section 116.

4835. Numéro spécial consacré à la protection de la nature. **[Special number on the protection of nature.]** *Rev. for. franç.* 7 (5), 1955 (337–435 + 36 photos + 3 maps). [F.]

Includes articles on: The zoological and botanical reserve of the Camargue (*C. Bresson*); Soil conservation (*A. Oudin*); Wooded areas in parks and promenades, their maintenance and regeneration illustrated from the Bois de Boulogne and the Bois de Vincennes (*E. Toussaint*); The management of forest zones for the protection of wild life (*F. Vidron*); The Mercantour (Alpes Maritimes) nature reserve (*A. Dugelay*); Nature protection in Languedoc (*J. Prioton*); The national parks and nature reserves of Ubangi-Shari (*L. Duplaquet*); The protection of lakes and ponds (*P. Vivier*) [12 refs.]; Nature protection: the microbiocoenosis (*P. Hervé*); The development of insect populations and the protection of the forests (*R. Joly*).

4836. **Agreements on afforestation in the Lake District: reports by the General Informal Committee of the Forestry Commission and the council for the Preservation of Rural England.** H.M. Stationery Office, London. 1955. pp. 10. Price 6*d.*

Cf. *For. Abstr.* 16 (p. 303).

4837. Uusien luonnon- ja kansallispuistojen perustaminen valtion maille. **[Establishment of new nature parks and national parks on state-owned land.]** *Silva fenn.* No. 79, 1953. pp. 48 + 18 maps. [Fi.e.]

Report of the committee appointed in 1950 by the Finnish Government to consider the replacement of nature reserves lost through the 1944 armistice.

4838. JALAS, J. Rokua suunnitellun kansallispuiston kasvillisuus ja kasvisto. **[Vegetation and flora of the projected National Park at Rokua, central Finland.]** *Silva fenn.* No. 81, 1953. pp. 98 + map. [Fi.g.]

908. *Relationship to Other Branches of Husbandry and Industry*

4839. GREGORY, G. R. **An economic approach to multiple use.** *For. Sci.* 1 (1), 1955 (6–13). 3 refs.

Treats multiple use as a joint production problem and derives equations for its solution, illustrated graphically in the simple case of two products e.g. timber and forage, only. A three-dimensional graph shows solid histograms of the costs of production of each of these along two axes and a second graph is derived from this to show 'iso-cost' curves, identifying all product combinations that can be produced at equal cost. 'Iso-revenue' curves are next drawn against these and the points of contact joined to form the 'path of expansion' which contains every point of combined production that can be considered for maximum revenue. This path of expansion is swung through 90° and total cost and total revenue curves of combined production are drawn against timber production. From this can be read the cost of producing any combination represented on the expansion path against the total cost curve, and also the combination that will give the greatest difference between cost and revenue, i.e. maximum return. A means of quantifying 'intangibles' (e.g. scenic, or wildlife values) where these appear to be in reasonable balance with tangible production (timber etc.), through linking with the latter, is suggested.

91. LAND USE, LAND-USE POLICY (INCLUDING AFFORESTATION POLICY)

See also Nos. 4433, 4836.

4840. DARLING, F. F. [Editor]. **West Highland Survey: an essay in human ecology.** Oxford University Press, London. 1955. pp. xviii + 438 + 1 photo + 1 map. Price £1. 10*s.*

The section on the ecology of land use (by the editor) deals with tree growth and soil circulation; biological influences and effects in forest destruction; the practice of burning and its effect on vegetation, soil, and spread of bracken; erosion; and game preservation in relation to the forest/moorland complex and regeneration.

4841. STAMP, L. D. **The world land use survey with special reference to West Africa.** *C.R. Conf. int. Afr. Ouest, Abidjan 1953,* [1954] (80–2). [E.]

Summary of a paper in which the composition of the guiding commission, suitable scales, the master key for map presentation and progress in West Africa are noted.

4842. KETTLEWELL, R. W. **An outline of agrarian problems and land policy in Nyasaland.** Government Printer, Zomba, Nyasaland. 1955. pp. 7. Price 1*s.* 3*d.*

4843. **Agriculture and forestry: competition or coexistence?** *International Journal of Agrarian Affairs, Oxford* 2 (2), 1955 (91–185). Price 5*s.*

The entire number is devoted to the subject and contains papers on the following countries: Costa Rica (*L. R. Holdridge*); France (*P. Froment* and *F. Houillier*); Germany (*C. von Dietze*); Great Britain (*L. K. Elmhirst, J. R. Currie, W. E. Hiley,* and *J. J. MacGregor*); Greece (*C. Dragonas*); India (*S. R. Sen*); Norway (*A. Eskeland*); and the United States

(*H. H. Wooten*); a paper on Sweden (*E. Swedborg*) is to appear as a supplement.

4844. ROLDÁN CADAVID, J. Apuntes sobre reforestación en Antioquia. **[Reforestation in Antioquia [, Colombia].]** *Rev. Fac. nac. Agron. Medellín* 16 (47), 1955 (5–65). 12 refs. [Span.]

Antioquia can be divided into 3 climatic regions: (1) cool, where presence of population, burning of the forest for agriculture, and over-exploitation, especially of valuable species, coupled with adverse ecological factors, have all combined to cause widespread devastation of the forests; (2) temperate, where over-exploitation of valuable species, and clearance for cultivation and grazing have caused much devastation, but where the effects are offset to some extent by widespread cultivation of coffee under shade and by the good quality of the soils; and (3) hot, where devastation of the forests has been severe in the western part, but elsewhere there exist considerable reserves of forest land. The effects of deforestation on the economic and social life of Antioquia are considered and basic principles for the direction of a reforestation and conservation campaign reviewed. The history of forestry and forest conservation in Antioquia is briefly summarized and plans are outlined and discussed for a programme of administration, research, afforestation and education in the 7 regions into which the department is already divided for administrative purposes.

92. FOREST OWNERSHIP AND OWNERSHIP POLICY

See also Nos. 4433, 4438.

4845. PARANT, E. Réserve affouagère et série financière. **[Firewood reserve and financial series.]** *Rev. for. franç.* 7 (1), 1955 (30–5). [F.]

French communal forests are usually subject to rights of 'affouage' (collection of firewood) and are managed on the basis of one-fourth held in reserve ('Quart-en-Réserve') and the rest a 'série ordinaire' cut over for firewood, usually by contractors. The result is an enormous area of degraded coppice. The author suggests a survey of the whole position, reservation of a suitable area for firewood cutting, and management of the remainder on a proper economic basis for the benefit of the commune.

4846. COINTAT, M. L'affouage et les aménagements. **[Firewood-cutting rights and forest management.]** *Rev. for. franç.* 7 (7), 1955 (529–33). [F.]

Seeks from actual examples answers to the questions 'Is the amount of firewood produced in the reserved parts of communal forests in excess of or inadequate for the needs of the actual population?' and 'Is coppice the only system able to satisfy the firewood-cutting rights?' Concludes from conditions in the Haute-Marne, that the present production is inadequate, but that the same area managed as high forest would be more than adequate.

93. PUBLIC SUPERVISION AND REGULATION OF FORESTRY, INCLUDING LEGISLATION FOR THESE PURPOSES

See also Nos. 4818, 4845–6, 4855.

4847. WILKINSON, G. A. **The new Indian law and its forestry implications.** *J. For.* 53 (3), 1955 (167–8). 5 refs.

Gives details of large forest tracts in Indian territories, hitherto managed for sustained yield and now endangered by the provisions of the Withdrawal Acts of 1954 of U.S. Congress.

4848. JAMES, N. D. G. **Trees and litigation.** *Quart. J. For.* 49 (3), 1955 (165–74).

Gives a short account of the more important cases dealing with damage by fallen trees and overhanging trees, poisoning of farm stock by poisonous trees, and trespass by tree roots, settled in English courts during the past 70 years, with a reference in each case to full reports.

4849. Metsänhoitolakikomitean mietintö. **[Report of the forest management law committee.]** *Silva fenn.* No. 83, 1953. pp. 116. [Fi.e.]

Report of a committee appointed in 1946 to draft a law to supersede the 1928 Law on Private Forests. The proposals include measures to ensure the conservative exploitation of private forests and set the responsibility for ensuring regeneration upon the forest owner.

94. OTHER METHODS TO IMPLEMENT FOREST POLICY

941. *State Subsidies etc.*

See No. 4438.

943. *Forest Insurance*

See No. 4198.

945.2. *Publicity, Propaganda (including Demonstration Forests)*

4850. **The University of Tokyo University Forests: information.** Tokyo University Forests, Tokyo. 1955. pp. 13. [E.]

Describes briefly the work of the University experimental forests in Chiba, Saitama, Aichi, Yamanashi, Shizuoka and Hokkaido prefectures.

945.3. *Education. Training*

4851. Metsänhoitajien jatkokurssit 1952. **[The continuation course for forest officers 1952.]** *Silva fenn.* No. 80, 1953. pp. 112. [Fi.e.]

Includes the following lectures, with English summaries: Trade cycles and forestry (*M. Lappi-Seppälä*); The training of forest foremen (*V. O. Sierla*, and *J. J. Arvela*); Treatment of inaccessible forests (*E. K. Kalela*); Silviculture in Finnish state forests (*V. K. Ahola*); Management of swamp forests (*P. B. Mansner*); Mechanized soil preparation in cut-over forest (*T. Hautamäki*); The use of weedkillers on seed spots (*E. Paavola*); Selection and registration of élite seed trees (*R. Sarvas*).

4852. **Cyprus Forestry College prospectus and syllabus.** Government Printing Office, Nicosia. Rev. ed. 1954. pp. 12 + 6 photos.

945.4. *Research*

4853. **Research programme (including Progress Reports for 1953).** [Forest Research Institute, Kepong.] *Res. Pamphl. For. Res. Inst., Kepong* No. 15, 1954. pp. 140.

946.2. *Conferences and Excursions*

4854. VELLOZO, L. G. C., and MUNIZ, P. J. COSTA [Editors]. Primeiro Congresso Florestal Brasileiro—conclusões finais. **[First Brazilian Forest Congress—final conclusions.]** *Ediç. Prop. Serv. flor. Est. S. Paulo* No. 41, [1953]. pp. 8. [Port.]

The recommendations include clauses dealing with forest protection, the creation of reserves, afforestation, fire control, education, propaganda, research and the forest products industry, in Brazil.

95. FOREST TAXATION

4855. ERDLITZ, E. W., and TRENK, F. B. **The forest tax laws of Wisconsin.** *Circ. Wis. Coll. Agric. Ext. Serv.* No. 479, 1954. pp. 6.

96. FOREST LABOUR QUESTIONS. LABOUR QUESTIONS IN WOOD TRANSPORT AND THE WOOD INDUSTRIES

See Nos. 4116–7.

97. INTERNATIONAL FOREST POLICY AND OTHER INTERNATIONAL COLLABORATION

971. *Congresses, Conferences*

See also Nos. 3964, 4229, 4447.

4856. Comptes Rendus, 11ième Congrès, Rome, 1953. **[Proceedings, Eleventh Congress [of the International Union of Forest Research Organizations] Rome, 1953.]** International Union of Forest Research Organizations [Zürich] 1954. pp. 1103. [F.]

The printed proceedings, consisting of 3 parts: official records, section discussions and papers presented at the congress [these have already been referenced in *For. Abstr.* Vols. 14 and 15].

References: 1. *Aerial Survey Review*, London; 2. *Chêne-Liège*, Constantine; 3. *Colonial Development*, London; 4. *FAO Press Release*, Rome; 5. *Farming in South Africa*, Pretoria; 6. *Forestry Commission Leaflet*, London; 7. *FPRS News Digest*, Madison; 8. *Nature*, London; 9. *New Commonwealth*, London; 10. *Report of the Department of Agriculture, Bermuda 1954*, Hamilton; 11. *Report of the Department of Forestry, Fiji 1954*, Suva; 12. *Report of the Forestry Commission N.S.W. 1953–54*, Sydney; 13. *Southern Lumberman*, Nashville, Tenn.; 14. *Timber Trades Journal*, London; 15. *Times*, London; 16. *Unasylva*, Rome.

International.

FAO. One of the T.A. experts in Asia considers that actual consumption of fuelwood in some Asiatic countries is twenty to twenty-five times as great as that reported in official government statistics. The exact ratio of actual to official figures in the consumption of fuelwood is not known in many countries, but the discrepancy between the two can be safely assumed to be very great, and it is clear that fuelwood plays a much more important role in the economy of under-developed countries than has heretofore been recognized (**4**; Aug. 1955).

The project of preparing an Arabic vocabulary of forestry terms is progressing. Provisional lists of words and definitions, with English and French equivalents, have been completed, and are to be submitted to universities and administrative organizations in the countries affected, to reconcile differences (**4**; Aug. 1955).

The agenda of the 5th Session of the Latin American Forestry Commission (Caracas, 4–15 Oct.) includes the review of regional projects, such as grading of timber in the La Plata region, control of forest fires, plantations for production of fuelwood and pulpwood, and forest protection against insect pests in Central America (**4**; Aug. 1955).

FAO Conferences.	1955
International Chestnut Commission	Rome 19–24 Sept.
Near East Forestry Commission 1st Session	Teheran 24–29 Sept.
Latin American Forestry Commission 5th Session	Venezuela 26 Sept.–Oct.
Joint FAO/IUFRO Bibliographical Committee	Stockholm Sept.
IUFRO Permanent Committee	
European Forestry Commission 9th Session	Rome 10–15 Oct.

Other Conferences.

International Conference of Forestry and Sawmill Workers	Gävle, Sweden	8–12 Aug. 1955.
Seventh International Grassland Conference	New Zealand	6–15 Nov. 1956.

A third international conference on plant growth substances was held at Wye College, Ashford, during 17–22 July, 1955. The subjects of discussion were: natural auxins; chemical structure and biological activity; metabolism of auxins; mode of action of auxins (**8**; 2.7.55).

Australia. Work is being done by the N.S.W. Forestry Commission on non-destructive methods of determining the soundness of logs. Successful experiments have been made on the rationalization of the axe-sounding method and it is hoped to develop equipment for this. An alternative method, based on the use of a low-energy source of gamma radiation, and measuring either the direct transmission pattern or the backward scattering, has been examined in a preliminary way. It is hoped to develop this as a practical technique, the results so far obtained having indicated that it is capable of differentiating between sound wood and holes (**12**; 1955).

Bermuda. The infestation of Juniper scale (*Carulaspis visci*) which has killed much of the native Cedar (*Juniperus bermudiana*) since 1944 is no longer as severe as it was in its early stages, and there is reason to hope that some of the more robust survivors may live and reproduce themselves. In many areas, thousands of Cedar saplings are appearing among the dead trees. Meanwhile, *Nerium oleander*, an important ornamental species, is now threatened with destruction by two scale insects, *Pseudaulacaspis pentagona* and *Pulvinaria psidii* (**10**; 1955).

A scheme is now under consideration for using the dead Cedar trees, over a million of which now disfigure the colony following infestation by scale insects. A U.S. expert has examined the dead trees and is of the opinion that the quality of the wood is so good that both stems and branchwood could be used for the manufacture of hardboard. Government is considering setting up a factory for this purpose (**9**; 8.8.55).

Canada. When a ranger in the Chapleau district of Ontario discovered a subsidiary fire, 3 miles away by land from a main fire, but only a quarter of a mile by water, he hurriedly built a raft and tried to propel it across the lake by poling, but the wind was too strong for him. He then set a petrol-powered fire pump on the raft, and by using the pressure of the nozzle over the stern, propelled it across the lake. After putting out the flames with the same hose, he went back to fight the main fire (**15**; 9.8.55).

Colombia. An American ethnobotanist, Dr. Richard Schultes, has discovered a rare and dangerously narcotic tree of great beauty and debatable classification grown by Indian witch-doctors in the Sibundoy Valley of Colombia. The tree, which has been named *Methysticodendron amesianum*, is unknown in a wild state. It has long, narrow leaves and large, pendulous, strongly fragrant, white flowers, and resembles a tree Datura in habit. It has been placed, with some hesitation, in the family Solanaceae, and constitutes a new genus. Its use in each tribe of Indians is restricted to a number of witch-doctors, who grow it with special care in the neighbourhood of their huts. Apparently the plant and the secret of its use are hereditary in certain families. The intoxication produced by taking an infusion of the leaves induces frenzy and narcosis lasting 2–4 days with a long period of complete unconsciousness, and the witch-doctors resort to it only in very important or difficult cases of divination, prophecy, or therapy. Plasters made from the leaves and flowers are used for the reduction of tumours and swellings. It is probable that the active principles are solanaceous alkaloids of the tropane series to which hyoscine and hyoscyamine belong. Plants are now being grown at Bogota and Popayan in Colombia, Beltsville (Md.), Cambridge (Mass.), and at Kew Gardens (**15**; 3.8.55).

Fiji. A new system of measuring forest produce on the felling site instead of at checking station or sawmill has been introduced in all concessions. In spite of a certain amount of opposition from loggers, the system is working well. The advantages of the new system from the forestry point of view are that the forestry staff is performing its proper function in the supervision of forestry work, with consequent improved management, and there is no loss of revenue on timber cut, through short lengths or whole logs being left in the bush, or on forest produce lost between the felling area and checking point. From the statistical and control point of view, individual logs can be traced to a particular tree, and the log returns are now valuable for the building up of yield tables (**11**; 1955).

France. The new forest law which came into effect in Dec. 1954 provides for the grouping of scattered private forests, or land destined for afforestation, with a view to facilitating proper management, silviculture, protection, and planting, and overcoming the defects of fragmented ownership of forest land. Under the law, 'forest groups' can be formed whose members (whether individuals or corporate bodies) are exempt from taxation on property that they bring into the group (**16**; June 1955).

A consultative committee to promote the use of wood and other forest products has been set up by the Ministries of Agriculture and of Industry and Commerce. It will consist of representatives of these and other Ministries, of private and communal forest owners, of the timber trade, and of wood-using industries. Its duty will be to study the subject and make recommendations to the interested Ministers for the conditions under which subsidies should be granted to assure the extension of uses of wood and forest products (**2**; 1.7.55).

Great Britain. Since the beginning of the intensive campaign against the grey squirrel was begun in 1953 (i.e. in 2 complete years) 753,527 grey squirrels have been killed, and the Forestry Commission's shilling award was claimed in respect of 590,653 tails, involving payment of nearly £29,533. The number killed in the last 6 months of the period was the lowest in any 6 months since the campaign began (63,000 less than the previous 6 months), which seems to show that the campaign is proving a success (**6**; 21.6.55).

The Nature Conservancy has announced the establishment of several new nature reserves. The first of these, the Wychwood Forest Nature Reserve, covers 647 acres of mixed woodland about 7 miles west of Woodstock. The mixed fauna and ground flora are rich, and it is intended that the reserve shall be a permanent forest, regenerating naturally and consisting of indigenous species of hardwoods

on a long rotation. The reserve will be used for scientific research and will not be open to the public. The Hales Wood Nature Reserve covers only 20 acres, about 2½ miles from Saffron Walden, in Suffolk, and is one of the best-known examples in Britain of Oak/Ash woodland on chalky boulder-clay, where the true oxlip has replaced the primrose in the herb layer. The shrub layer consists mainly of Hazel, with occasional Maple, Blackthorn, Dogwood, and the large Guelder Rose. As the wood must be kept undisturbed, access permits can be granted only in very limited numbers and for special reasons (**8**; 6.8.55).

Mr. and Mrs. Eric C. Hiscock, who recently completed a voyage round the world in their small yacht *Wanderer*, said: 'We have had trouble with certain metals and plastics and modern fittings, but the good stout hull, framed with English Oak, planked with Iroko [*Chlorophora excelsa*] from Africa, and copper fastened, shows not the slightest sign of movement or decay'. (**14**; 23.7.55).

The National Coal Board's drilling tower for the exploration of submarine coal will have, slung below its upper deck, 40 ft. above the sea, 11 buildings, the design and construction of which has been entrusted to Medway Buildings and Supplies Ltd. of Rochester, Kent. Six of these are living quarters for 4 men (4 cabins, bath or shower and toilet); the others are a recreation room, galley, mess, power house and generator room (insulated acoustically). The total weight of these buildings is limited to 50 tons and each unit is braced to lift in one piece. The frame is based on 6 × 2 in. verticals at 4-ft. centres and the walls, which have to withstand wind pressures of 56 lb./sq. in. have an outside skin of ⅜-in. exterior-grade plywood and an interior lining of fibreboard, the cavity being filled with glass wool giving the thermal insulation of a 3-ft. wall (**14**; 4.6.55).

Iraq. Hunting Aerosurveys Ltd. have recently carried out a forest inventory of a pilot area (540 sq. km.) in northern Iraq for the Iraq Forestry Department. The aim of the survey was to give some idea of the volume of timber available for exploitation. Both Pine and Oak forests were included in the area, and sample plots were laid out and enumerated in each forest type. A preliminary photo interpretation was carried out, to determine the relative density classes and the distribution of sample plots. Height and d.b.h. were recorded for all trees on sample plots, and increment cores taken from selected trees. Notes were made on the ecology of the area, and representative specimens of plants, insects, and timbers, as well as soil samples, were taken (**1**; 1955).

Netherlands. The long-awaited Forestry Board (*Bosschap*) was established by royal decree in 1954. It is a public body with legal powers to enact decrees, and with control of State forests and all forestry enterprises, irrespective of size or title. There are 14 members of the board, of whom 7 represent employers' organizations (1 for State forests, 1 for municipal forests, and 5 for privately owned forests), and 7 the recognized employees' organizations (the 3 agricultural workers' unions to which the forest workers belong). The Board's regulating powers include: (1) the growing of forest crops and the production of forest products; (2) storage and processing of forest products; (3) management of forest estates; (4) standardization of timber commodities; (5) recruitment, dismissal, wages and working conditions of forest employees other than government employees; (6) inspection and registration of forestry enterprises (**16**; June 1955).

S. Rhodesia. Although the Federal Government has now agreed to institute an inquiry into tsetse-fly control in South Rhodesia, there is as yet no sign of a workable alternative to game destruction, which continues at the rate of more than 3000 head a month. Experiments have, however, been made on alternative methods, with varying success. A 40-mile-long barrier to halt the invasion of fly from Portuguese East Africa near Chipinga has been established by clearing more than 60,000 acres of bush, but it costs £7000 a year to maintain this clearing by slashing back regrowth. Two Europeans and 300 Africans are permanently engaged in this task. The 1953–4 aerial application of insecticides was tried out. Many difficulties were encountered, including failure of the aerosol to penetrate dense canopy, convection currents, atmospheric turbulence, and wind. Experiments are now being made with swing-fog applicators, which release the insecticide as a smoke at ground level and can be operated at night, when meteorological conditions are most favourable (**9**; 10.1.55).

Swaziland. The Colonial Development Corporation's scheme for afforesting some 100,000 acres of grasslands along the Great Usutu River, began in 1949, and 55,000 acres of Pines have now been planted. The principal species are *Pinus patula*, *P. elliottii*, *P. taeda* and some *P. pseudostrobus*. Growth has been satisfactory, and the Usutu Forests are transforming the landscape of this hitherto almost treeless area. Negotiations are now taking place with interested commercial concerns to plan

the economic utilization of the timber for which the forests will soon be ready. The work has involved the establishment of nurseries to raise 40 million trees, the making of 190 miles of road, and the building of a 180-ft. bridge across the Great Usutu River, and the provision of employment to 1300 local African workers. As a supplement to the main scheme, 3500 acres are being planted on behalf of the Swazi people to form a national forest (**3**; 1955).

Tanganyika. The Colonial Development Corporation's project to establish 30,000 acres of Black Wattle (*Acacia mollissima*) near Njombe in the Southern Highlands of Tanganyika over a period of 6 years and then to extract the bark for tanning materials, will introduce a new industry to this underdeveloped area. By the end of 1954, over 22,000 acres had already been planted. Plans and estimates for a processing factory have been completed, and it is expected that the production of tanning extract will begin in 1959. Help will be given to the neighbouring Bena tribe to establish up to 20,000 acres of its own Wattle, which will be processed in the Corporation's factory. Development of this project has required the construction and maintenance of over 370 miles of road, the building of workshops, stores, and workers' houses, and the installation of water and electricity supplies. It has provided regular employment for over 1000 local workers (**3**; 1955).

Union of South Africa. Work has been carried out by the Division of Entomology in the study of the white wax scale *Ceroplastes helichrysi* which is infesting Jacaranda trees lining the streets of Pretoria. A number of parasites have been found, but they do not exercise any appreciable control of the pest. The trees do not appear to suffer from the infestation. One of the worst features of the scale is the mess it makes by dropping honeydew and wax on cars parked under the infested trees (**5**; March 1955).

U.S.A. A giant land-clearing machine of great power, the 'Le Tourneau Tree Crasher', fitted with bulldozer blade, has been constructed in Texas. Each of its six wheels, which are 10 ft. in diameter and equipped with enormous balloon tyres 4 ft. wide, is fitted with an individual electric motor and gear reduction within its rim, powered in turn by two giant Diesel engines. The weight/sq. in. of the machine, which can uproot large trees as well as clear and carry away underbrush in one operation, is said to be no more than that of a man, thus making it particularly suitable for use on sandy and swampy areas (**13**; 1.8.55).

Furniture and fittings of hardwood plywood included in the nuclear explosion test at Las Vegas were only superficially damaged. The furniture did not retain radio-activity and could be used again at once after the surface had been wiped or washed. Interior plywood walls, ceilings and built in fittings remained intact, not even splintering (**13**; 15.7.55).

At the 9th national meeting of the F.P.R.S. in June, announcement was made of a potentially important new raw material, 'Dendrol', produced from wood waste. Dendrol, a solid, dark-brown lignin derivative has already been tested on a commercial scale. It has some of the properties of thermosetting phenolic resins, and a variety of possible industrial uses are suggested e.g. as a phenolic resin for moulding materials, laminating varnishes, hardboard binders, and phenolic-resin papers. Experimental results indicate that Dendrol could be substituted for 75–95% of conventional materials in these applications without appreciable loss in quality. As a moulding compound it would cost 6·5–8 cents/lb. and could be sold at $\frac{1}{2}$–$\frac{1}{3}$ the price of conventional materials (**7**; July 1955).

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